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KAFIRISTAN.*

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THE country about which I hope to be able to interest you to-night was, up to a few years ago, entirely unknown and unexplored, and still remains one of those few inhabited regions of the world only partially understood. Many accounts have been given us by painstaking compilers of the narratives of various more or less trustworthy Oriental travellers, who had visited, or professed to have visited, the sombre valleys and the wild independent mountaineers who people this little-known land, and the genius of Rudyard Kipling selected this very country as the scene of one of his most remarkable stories—the story of the man who would be a king. I am compelled to confess that Mr. Kipling's exquisite story is not one whit more imaginative or less true to exact fact than many of the narratives of those earlier writers I have referred to.

The whole district is known by the name of Kafiristan, which literally means "the land of the Infidel," just as Hindustan means "the land of the Hindu" and Afghanistan "the land of the Afghan." This designation, originally applied to the country as a term of reproach by the Mohammedan peoples, by whom it is now completely encircled, is so well known to scientific geographers and other learned men, and has been so long accepted as the true name of the whole country, that it would be unwise and confusing for us now to change it, even if we had any other word at our command which would more correctly and definitely explain our meaning. Moreover, the term "Kafir" is readily accepted by the people to whom it is applied, who may indeed be said

* Paper read at the Royal Geographical Society, June 25, 1894, Map, p. 288.

to glory in the title, although it is one which they themselves are quite incapable of pronouncing.

Kafiristan, then, is a geographical expression used to designate the country of those non-Mahomedan tribes who inhabit that space left blank in our maps, which is bounded on the east by Chitral and the Kunar valley, on the south-east by the Kunar valley, on the west by Afghanistan, and on the north by the Hindu Kush and by Badakhshan. Politically speaking, the whole region is bounded on the east by Chitral and the debatable land of the Kunar valley, and on all other sides by Afghan territory.

Before my own visit to Kafiristan, with one single exception, no other European had ever penetrated there. The exception referred to was Lockhart's mission, which in September, 1885, crossed from Chitral into the upper part of the Bashgul valley, remained there a few days, and then withdrew into Chitral by another road.

The gallant McNair, whose untimely death deprived the Indian Survey Department of one of its most resolute and enterprising officers, never entered the real Kafir country at all; he only succeeded in reaching some of the Kalash villages of Chitral, which he mistook for the true Kafiristan. The Kalash referred to are an idol-worshipping tribe, slaves to the Mehtar of Chitral, and must not be confounded with the independent mountaineers of Kafiristan, from whom they differ in language, dress, manners, and customs, but still more notably in their mental and physical characteristics.

The actual amount of country I was able to explore was not of any great extent. I traversed the whole of the Bashgul valley, and many of its subsidiary valleys, from end to end, and crossed from it into the top of the Minján valley of Badakhshan. I also examined the Kunar valley, and many of its side valleys from Mirkani to Bailam. Finally, I penetrated into one of the inner valleys of Kafiristan, called Viron or Wiron by Mahomedans, and Presun by the Kafirs. This is probably the most sacred, as it is certainly the most interesting, place in the whole country. In accomplishing this very limited amount of travel I expended more than a year. Tribal jealousies were so great, and my position was oftentimes so difficult, that it was frequently a question, not of my being able to get on, but of my being able to maintain myself in the country at all; while on one occasion the uncomfortable suggestion was fiercely debated if it would not be advisable for the tribe to keep me a close prisoner for three years, and compel me during that period to send to India for as much money and as many rifles as my proposed custodians should see fit to demand.

On another occasion I was civilly but decidedly told by my first entertainers, the Kam tribe, that I must leave their country altogether. I not only had to comply with this order, but they also refused to allow me to proceed straight up the Bashgul valley to the country of another

tribe, the Lutdeh Kafirs, who had been clamouring for a second visit from me, and, as an inducement, had promised to take me to the valley occupied by the Presun or Viron people, to whom I have already slightly referred. Unfortunately, however, the Lutdeh men had in the mean time raided through the Presun valley, and into the territory of another tribe I was most desirous of visiting. This complicated matters very greatly; and when I reached the Lutdeh people, after a toilsome round-about march over the hills, I found to my mortification that their fervour in my behalf had greatly cooled down, and that under Chitral influence, which was then very strong with them, they were no longer desirous of my remaining in their country. Under these circumstances, and also to gain time, I was compelled to seek the hospitality of an old outlaw, who most kindly entertained me for some days, when we parted, he to leave Kafiristan for ever, as the place had become too hot for him, and I to try and discover some means of getting back to my first entertainers, the Kam. After much trouble and difficulty, I eventually succeeded in doing so, and returned to Kamdash to find that village on the verge of furious fighting on my account. It was only after great effort that bloodshed was avoided, and the tribe, reunited for the moment, agreed to take me to that inner valley on which my heart was set. My journey there was sufficiently uncomfortable. My escort consisted of my active opponents amongst the Kam people, for it was only on my consenting to be so accompanied that fighting was avoided, and it was possible for me to go on at all. I trusted, moreover, to my personal influence over the unruly members of my escort, so soon as we had once started away from the village, to enable me to get on satisfactorily; but, unluckily, I fell ill on the march, and was consequently unable to restrain the first beginnings of a disturbance which eventually grew to serious dimensions. My companions tried every dodge Kafirs know of bullying and black-mailing. Each succeeding morning brought its daily quarrel. Sometimes they deserted me altogether, or pretended to do so, and always tried this manœuvre at some more or less critical moment — as, for instance, when we were in a village supposed to be dangerous and hostile to us. Finally they became so outrageous that they rushed my tent, secured my firearms, arrested my servants, and I myself was compelled to escape from them over a fort wall during the night, to avoid being tied to poles and carried off a prisoner.

Amongst all these disturbing influences it might be thought that my life was not of a kind conducive to quiet observation, or the drawing of careful deductions from what I actually saw; but as a matter of fact there comes a time, much sooner than might be imagined, when conduct which under other circumstances would be justly considered outrageous, is accepted as a matter of course, and one's life flows on as placidly under strange and unprecedented conditions, as if one were merely involved in the ordinary everyday petty worries of civilized life.

Then possible dangers no longer appeal to the dulled imagination, and if they do eventually arise, they are yet found to bring with them their own peculiar compensation. It may be said with truth that my Kafir friends unconsciously did everything in their power to keep my mind active, and prevent its stagnating from monotony. So, therefore, if I failed in observing those things which I ought to have observed, the cause of failure must be held as due to my own deficiencies, and not as the result of the odd behaviour of my friends. When the time came for me to leave Kafiristan, which I did with the almost too cordial approval of my hosts, I went away with something very like regret, and with a fixed determination to return the following year, when affairs might be expected to have quieted down a little. That determination, however, was never carried out; it is probable now that it never will be, and perhaps the wish to do it is much less strong than it was, even if it exist at all. Yet I now and always shall feel kindly disposed towards the Kafirs. Several of them are my sincere friends, large numbers are well disposed towards me; and no blood lies between us. In some of the broils and turmoils blows were exchanged and one or two wounds inflicted, but no single man was killed or even seriously injured on my account. I never had to fight Kafirs myself, nor was I ever actually attacked by them. Indeed, in spite of their violent behaviour at times, I have more than once been assured by my most troublesome opponent that they bore me personally no ill-will whatever, for, as they said, I had never wronged nor injured any of them. They admitted that all their anger was roused by the suspicion that I gave money and other presents to certain of their fellows, while their peculiar notion of independence was, that all should share and share alike in my favours, whether they had done any actual work for me or not.

As an instance how comparatively easy these wild people are to manage, I may mention that I have sometimes sat placidly watching a Kafir parliament, when from the fierce gestures in my direction, made with splendid dramatic action by men pale with rage, any one unacquainted with the people might have fairly assumed they were demanding me as their sacrifice, and when their words were no doubt outrageous enough, could I have fully understood them. When the disaffected in a body have sprung to their feet and left the camp, so to speak, I have on such occasions more than once stopped one of the furious throng to ask some trivial but kindly question about his family. The result was almost invariably the same. The choking madman would glare at me for an instant, cast a wild glance at his companions, give a rueful kind of smile, and nod his head or wave his hand if he were too much discomposed to be able to reply in words.

There were, indeed, critical moments when a conflict seemed inevitable, yet it never occurred. Absolute command of one's temper—and it is

curious how completely a real crisis quiets the anger of an Anglo-Saxon and clears his mind—is a most potent weapon with which in nine cases out of ten a Kafir can be utterly defeated, provided always that he has no real injury to avenge. All the time I was in Kafiristan I hardly had anything stolen. I have had sheep carried off, and, as I have already mentioned, my guns were on one occasion seized, but I got all my property back again in every single instance; I even made some Kafirs give up the property they had plundered from a man discharged from my service, and whom they consequently looked upon as their lawful prey. When the fact is carefully remembered that these same Kafirs are hereditary brigands and assassins, there is little wonder that I should feel kindly disposed towards them for their average treatment of me—a man so entirely different from any one else they had ever seen.

Kafiristan consists of an irregular series of main valleys, for the most part deep, narrow, and tortuous, into which a varying number of still more difficult, narrower, and deeper valleys, ravines, and glens pour their torrent water. The hills which separate the main drainage valleys the one from the other are all of them of considerable altitude, rugged and toilsome. As a consequence, during the winter Kafiristan is practically converted into a number of separate communities with no means of intercommunication. Take, for example, the Bashgul valley: during the time the hills are under snow, the only way to reach the Katir people who inhabit the upper portion of the district is to travel from the Kunar valley through the territory first of the Kam and then of the Mádugal tribe. Supposing either of these two tribes be at war with the Katirs, the last named are then completely isolated from the rest of the world, until the passes open in the spring. The inhabitants of Viron or Presun are similarly cut off from the surrounding tribes, for the only entrance to their country, when the passes are closed, is up the river which flows into the Kunar at Chigar Serai. All the passes which lead from Badakhshan into Kafiristan are certainly over 15,000 feet in height. I myself have only explored two of these, each of which was above the altitude mentioned, and I was assured that those two were the lowest of the series. On the Chitral side the roads over the enclosing ranges, although somewhat less elevated, are still very high, and are completely closed by snow in the winter. There is one low ridge 8400 feet between the Kalash village of Utzun and the Kafir village of Gurdesh, but even that is impassable for two or three months every winter.

Some of the ravines up which regular roads run are of most picturesque and romantic description, others are bare rocky glens. Indeed, many various kinds of scenery are to be met with according to differing altitudes and to other circumstances. At the lower elevations fruit trees abound, and in the hot weather the traveller pushes his way

along the torrent's bank through thickets and tangles of wild grapes and pomegranates. At such low elevations splendid horse-chestnuts and other shade trees afford pleasant resting-places, while the hill-slopes are covered by shrubs, wild olive, and evergreen oaks. At somewhat higher elevations, say from 5000 to 8000 or 9000 feet, dense pine and cedar forests abound. They are composed of magnificent trees, which with a snow background afford most delightful prospects. Higher still, the pines cease; the hills are then almost bare, rocky, shaly, etc.; while the willow, birch, and the juniper cedar are the chief trees met with, and the wild rhubarb grows abundantly. Higher still—that is to say, above 13,000 feet—there is no vegetation of any kind, except rough grasses and mosses.

The rivers, as they descend the corkscrew valleys and are fed by subsidiary streams from the ravines, glens, or mountain recesses, increase in velocity until they become raging torrents, dashing against the huge boulders which obstruct their course, and flinging high their spray with deafening uproar. In many places where the tortured water foams and lashes itself against the rocks on its margins or in its bed, the river almost assumes the nature of a cataract, and is indescribably beautiful. Tree-trunks encumber the waterway, jam themselves against the rocks, pile up in picturesque confusion, or hurry round and round in the swirl of a backwater. To lovers of wild scenery many parts of Kafiristan could not be surpassed anywhere. In the autumn and winter months many of the valleys are in shadow very early in the day, and are strangely sombre and mysterious-looking. I always remember my first visit to Kafiristan in October, 1889, when a certain hot day's march was followed by the swift-coming afternoon shadow. How, tired out, I sat by the river's edge under a horse-chestnut, whose changing leaves alone relieved the deepening gloom. My companions were some distance away, while near at hand a hideous effigy transfixed me with its white stone eyes. The only human figure in the scene except my own, was a wild-looking man clad merely in a black goatskin, his long hair streaming behind, as he ran softly but swiftly down a rocky slope, hand on dagger, to discover who the intruder was. His movements were so noiseless, the valley was so deeply in shadow, and yet objects could be discerned so distinctly, that the whole seemed like a dream; and if ever I am suddenly asked what Kafiristan is like, this scene—the sombre valley, the wild river, the horse-chestnut tree, the fantastic effigy, and the hardly less fantastic man—rises at once before my eyes.

All the rivers of Kafiristan drain into the Kabul river, either directly or after first emptying themselves into the Kunar river at Arundo, Palasgar, Chigar Serai, etc. Of the valleys to the extreme west I know nothing except by hearsay, but I believe the Ramgul and the Kulam torrents joining together reach the Kabul river through Lughman. The

next valley to the east, the Kti, joins its waters with those of the Presun valley, and after receiving the Wai river, flows into the Kunar at Chigar Serai. The Ashkun rivers probably also join the Kti, and Presun torrents, before they empty themselves into the Kunar. The Bashgul river with its various tributaries, the largest of which are the Skorigul, the Nichingul, and the Pittigul streams, joins the Kunar exactly opposite the cultivated fields just above the "Gabar" village of Arundo.

The main roads of communication, if roads they may be called, are almost invariably along the river-banks, so narrow and so steep are the valleys. Although they vary very greatly the one from the other, they have this quality in common, that they are almost always extremely difficult. That part of the Bashgul valley above Chabu, as well as nearly the whole of the Presungul, is quite easy when you once get into those districts; but all other Kafiristan roads which I travelled over were simply abominable. Perhaps the worst of all are those on the left bank of the lower part of the Bashgul river and those in the Dungul valley. There it is rare to find even a couple of hundred yards of moderately level ground, so in marching it is one incessant clamber along rough stony tracks, which run over spurs and bluffs, or by means of frail wooden galleries across the faces of low precipices. Sometimes it is most difficult to get over the smooth rock surfaces; indeed, in some positions, where the ground is of this character, the inexperienced or badly shod traveller may only be able to proceed at all by edging himself along in a sitting posture. Dogs cannot get over those places without assistance. The bridges over the rivers are sometimes extremely well built, but are high above the water, and often not more than 18 or 20 inches wide in the middle, with parapets only a few inches high, so that the whole structure looks far more like an irrigation trough than a bridge. They are somewhat trying to the nerves, especially if you are suffering or are just recovering from an attack of fever. If this is a description of the good bridges, it may easily be conceived how extremely bad the inferior ones are. Sometimes a fractured tree hanging across a narrow stream is utilized as a bridge, and the traveller has to run along the tree-trunk at an angle dependent on the height at which the tree partially broke away from the parent stem. Yet these are pleasant and safe ways over the torrent, when compared with certain rickety old bridges, which groan and sway under you at every footstep. There is one in particular of which I have a most vivid recollection. My Balti coolies, five in number, who accompanied me throughout my journey, and who in their own native country are familiar with some of the most execrable bridges in the world, found the particular bridge of which I am speaking too trying for their nerves. Two of them had to be carefully helped over, although it was not more than 15 yards in length. When covered with hard slippery snow, pitted with the irregular frozen footsteps of travellers

who had gone before, it was distinctly dangerous. The jagged rocks in the torrent below always seemed to hunger for you to fall upon them. In many instances the bridges simply consist of a single pole or two poles placed side by side; it then requires a good head to cross them. The rope or rather twig bridge common in Gilgit, Chitral, and the Kunar valley is never met with in Kafiristan. The only one of that description with which I am acquainted, is placed every year across the mouth of the Bashgul river by the inhabitants of Birkot, for the convenience of Kafirs trading with them and with the other villages of the Kunar valley. In the Presun country the bridges are remarkably good. They are made on the principle of the dug-out boat from large tree-trunks, and are both easy and safe. They are often elaborately ornamented by the carved heads of animals placed at the end of long poles stuck at intervals along the parapet on both sides. There is one other point which makes travelling in Kafiristan difficult. I remember on one occasion being ludicrously embarrassed by finding my track abruptly stop at the foot of an unscalable bluff. The explanation of course was, that I had reached a wading-place, of which there are several between Kamdesh and Lutdeh. Some of them are of considerable extent and easy enough, except for the sharp stones in the river bed, which are apt, if you are wading with naked feet, to pain you into a stumble and a ducking; but others are actually dangerous both from the force of the water and from its depth. Yet the worst I know was only up to the waist and of short extent, the footway being an under-water ledge at the foot of a precipice. It was very hard to keep close enough to the rock to remain on the ledge, and not be washed out into the raging torrent. At that place dogs had to be dragged through anyhow, and the unfortunate animals sometimes emerged from the ordeal more than half drowned. At all the wading-places, particularly during the snow-melting season, the current is strong, and great caution has to be observed.

None of the passes are easy. They must be tackled according to their altitude, the amount of snow upon them, the season of the year, the time of day, etc. I suffered terribly on the Mandál Pass, but the reason was that the Kafirs gave me credit for being as good a mountaineer and as rapid a traveller as themselves. The result was that I arrived at the last climb late in the morning under a hot sun, and the softened snow not only gave me enormous trouble in surmounting the pass, but afterwards kept letting me through suddenly, dashing my feet against or between the stones concealed beneath it. At one of these mishaps my foot got firmly fixed for a considerable time, while the knee of the free leg was forced up somewhere near my chin. It took strong men, pulling hard, a considerable amount of labour before they dragged me out of my uncomfortable and helpless position.

But I must hurry on to describe the people, their organization into tribes, their manners, customs, etc. The time at my disposal will not allow of my giving much more than a cursory glance at these important points.

Of the origin of the Kafirs I will only say that, in my opinion, it will be ultimately accepted that the present inhabitants of Kafiristan are mainly descended from the old Indian population of Eastern Afghanistan, who refused to embrace Islam in the eleventh century, and fled for refuge to these difficult valleys, where they found ancient peoples, whom they subjugated, enslaved, or partially amalgamated with. These ancient peoples are probably represented at the present time by the Presuns, the Jazhis, the Arams, etc.

I have, I think, conversed with representatives of all the different tribes of Kafiristan, with the exception of a mysterious people called the Ashkun, who, from their inveterate hostility to the inhabitants of all the surrounding valleys, except the Wai people, are really as unknown to the great majority of the Kafirs as they are to me. They live in the district between the Ramgul and the Kulum on the one hand, and the Wai country on the other. From what I have heard of them, they appear to be separated from the Ramgul and Kulum Kafirs by a range of mountains. The rivers which drain their country flow into the united Presun and Kti rivers, a short distance above Chigra Serai. This people is probably akin to the Wai. Many of them are now Mohammedan, as are also several of the lower Wai villages.

In Kafiristan proper there are certainly three entirely distinct languages, besides many dialects. The language spoken by the greatest number is that used by the Siah-Posh people, so called because they affect dark-coloured, nearly black clothing. All the Siah-Posh, however, are not of the same tribe; but although there are dialectic differences in the languages used amongst them, yet they all understand one another readily, and their language may consequently be called the Siah-Posh tongue, a definition which, if not absolutely correct, is at least convenient. The other chief languages in Kafiristan are those spoken by the Wai and by the Presun people, which differ both from one another, and from the language spoken by the Siah-Posh. On this point many Bashgul Kafirs have assured me that any of their number who go to the Wai valley young enough, can easily learn the speech of that people, while no one under any circumstances, and no matter how young, can ever learn the Presun language.

The Presun are certainly unlike all other Kafirs; they are possibly an aboriginal race. I have listened most carefully to their priests and other officials chanting at sacrifices, etc., but I could never learn to repeat nor could remember one single word I heard; indeed, at those religious functions the sounds uttered by the officiating priests seemed to

me more like a soft musical mewing, than anything else I can compare them to.

Classifying the tribes according to speech, we have then, first, the Siah-Posh; secondly, the Wai, including probably the Ashkun; thirdly, the Presun.

The great majority of Kafirs are Siah-Posh. The tribes coming under that designation inhabit all the northern valleys of Kafiristan, although they are separated from one another at one point by the Presun valley, as you may see on the map. Amongst those I have called Siah-Posh the chief tribe is known as the Katir. They inhabit the populous west valley which borders on Afghanistan, and which is said to contain between twenty and thirty villages. In that situation they are known as the Ramgul Kafirs, or the Gabariks. To the east of the Ramgul country is the Kulam valley. It only contains four villages. Its main river joins that from the Ramgul valley, and flows into the Kabul river at Lughman. To the east of the Kulam valley reside the Kti branch of the Katirs. They possess but two villages, and one of these is very small. The Kti river, as I mentioned before, joins with the Presun and Wai streams, and falls into the Kunar river at Chigar Serai. Finally, the upper part of the Bashgul valley, as far down as the country of the Mádugál Kafirs, is also occupied by a branch of the great Katir tribe, which is more numerous than all the rest of the tribes in the same valley put together. In the lower part of the Bashgul valley dwell the important Kám Kafirs, with the Mádugál tribe to their immediate north, and the small Kashtán tribe to the west. Still lower down, there is the small village of Siah-Posh Kafirs, quite separate and distinct from all the other tribes. They are supposed to be partly composed of an aboriginal race called the Jazhis. The other chief tribes, the Presun and the Wai, occupy the positions shown in the map. What I have called branches of the great Katir tribe are really distinct and independent communities, but their intertribal organization is probably much the same in each case. Each tribe in Kafiristan is split up into families or clans, and the individual importance of any single Kafir depends entirely on the numerical strength of the clan he belongs to, and upon his own position in that clan. The affairs of a tribe are nominally arranged by the consultation together of the headmen, who are called "jast;" but, as a matter of fact, in ordinary times the business of a tribe falls very much into the hands of four or five of these headmen, or "jast," who are distinguished beyond their fellows for sagacity or valour, but who must also be the possessors of considerable wealth. Indeed, the importance of worldly possessions is very strongly, perhaps too strongly, recognized in Kafiristan. A man may be brave, devoted, and sagacious; he may have spent the whole of his flocks and herds and other property in becoming a "jast;" he may also be of good family; yet, if he be not possessed of considerable personal wealth, his weight in

the tribal council is comparatively small, except in the case of an orator, when to a certain extent he may atone by fervid speeches for lack of wealth.

A man can only become a "jast," or headman, by going through a prescribed ceremony, which lasts nearly three years with the Kam tribe; amongst the Katirs its duration is somewhat shorter. During that period he has to banquet the whole of his tribe on eleven different occasions, and entertain his brother "jasts" with ten separate feasts. He has to do this in conjunction with a woman who may or may not be his wife. She generally is not, for the expense of two people going through the ceremonies at the same time is so great, that none but the richest families can afford it. The usual plan is for the husbands to make a private arrangement amongst themselves, by which the wife of one man goes through the ceremonies with another individual, whose wife in her turn will reciprocate by distributing food in conjunction with the husband of the first woman. The woman's sole reward seems to be that she is permitted to attend one or two particular dances, and has also the privilege of wearing Markhor hair round the tops of her dancing-boots. The man, on the other hand, becomes an exalted personage, one of the great men of the tribe. The complete ceremonies for becoming a "jast" are elaborate and complicated. They would be tedious to listen to in detail. In the depth of winter the man grows a miniature field of wheat in his own living room, and this is remarkable amongst the Kám tribe as the only occasion on which a man interests himself or actually works in agricultural pursuits. He has also to wear a particular uniform on appropriate occasions, to make certain sacrifices, appear at the prescribed dances, sleep out at particular shrines, and for one period consisting of several weeks is never permitted to leave his village. It is a very curious custom that, although once a "jast" always a "jast," yet a very wealthy man is practically compelled by public opinion to keep on going through this ceremony again and again, or else he must make his sons and nephews, however young, headmen one after another. Unless he does this he is certain to fail in maintaining his influence and popularity with his fellow-tribesmen. Sumptuary laws are very stringent. No one but a "jast" would dream of wearing a bright-coloured robe at religious dances, nor a gaudy Oriental turban, unless in the case of a well-known warrior of good family, who might be invited to join the dance to complete the number of performers, in which case he also would be decorated something after the fashion of the others. One friend of mine, a plain man, a good but not particularly famous warrior, was, for some reason or other, very desirous of being allowed to wear red trousers. After giving six cows to be eaten by the villagers, this privilege was accorded him, but even then he seemed greatly ashamed of his finery, and always covered up the bright-coloured garment as much as he could with his long brown Chitrali

robe. The general idea seems to be that within certain well-defined limits, a man may swagger as much as he likes, provided he pays for doing so by feasting the villagers.

There is a sort of inner circle amongst the "jast," who, by further banquetings, are allowed what is considered the nearly royal privilege of seating themselves on four-legged stools outside a house. In the Kam tribe there were only five men and one woman entitled to this exclusive privilege. Anybody, men, women, children, slaves, may sit on these stools indoors, or on ordinary wooden benches outside, but to be permitted to sit on these queer little four-legged stools in the open air is only allowable to such as are considered "Mirs," or kings, in the tribe, although their royal function begins and ends with the four-legged stool.

For the ordinary management of internal affairs, of secondary importance, there is a kind of elective magistracy consisting of thirteen persons, who are changed annually. Their chief is known as the "Ur Jast," and is a very important personage indeed. The remainder of the number are merely his satellites, and slaves even are elected, as I shall mention when speaking of that peculiar class. The business of these men is to regulate the supply of water to the different fields, and to see that grapes and walnuts are not picked before the appointed time, while their chief is also responsible for the lighting of the fires at the dancing-house every Wednesday night, the commencement of a kind of Kafir sabbath, which occurs every seven days during the time field-work is being carried on by the women. The elected thirteen punish disobedience and other irregularities by fines, which, as they expressively put it, they eat themselves. On appointment their chief has to entertain the whole village. He is also expected to entertain public guests, but as he receives certain contributions in the shape of flour, etc., his office is believed to be as lucrative as it certainly is honourable. Under every circumstance in which a man is in any way exalted above his fellows he has to pay for the honour. For instance, there is a yearly competition in throwing an iron ball, believed to be of sacred origin. A great festival is made of the competition. The victor, instead of receiving a prize for his success, has to feast the whole village. I expressed my surprise at this custom, comparing it with the results of similar competitions in my own country. I was answered that Imra, the Creator, had made that man's arm strong, therefore of course he must give a feast in honour of Imra.

I shall not have time to go into minute particulars concerning the appearance of the Kafir people; indeed, it must be distinctly understood that to-night I deal in generalities only. Of the different tribes I have seen, the Wai tribe appeared to be the fairest, the Presun and some of the Katirs the darkest. In the Katir village of Pshower the inhabitants are almost black, but I subsequently discovered that their peculiar appearance was mainly due to the smoke-giving wood they use for fuel,

and to their extreme repugnance to washing. On a certain occasion I found a Presun man who, having escaped from an Afghan master, had made his way to Kamdesh. I noticed that this man had a comparatively fair skin. This bewildered me a good deal, until I saw him a few months later in his own home, when his complexion was just as dark as his fellows'. He possibly, as he lived in a cold country, had not thought it necessary to wash his face in the interval of our acquaintanceship. Speaking generally, the Kafirs are by no means fair, although they are equally removed from the black races. They are darker than many Badakhshis and Chitralis. Their colour is that of the average inhabitant of the Punjab. The lower classes and the slaves are much darker in tint than their betters; their features also are coarser. Red-haired people, or those of a more or less albino tint, are less than one per cent. of the total population. The usual type of feature is distinctly good—purely Aryan. The nose in particular is extremely well shaped. The degraded kinds are either the bird of prey type, or, as in many of the slaves, a flattish nose and coarse features. In some of these lower forms, the hair of the scalp reaches nearly down to the eyebrows, and gives its possessor a most forbidding appearance. Amongst the more important families, some of the men have singularly well-formed heads, and look as if, under favourable conditions, they might become statesmen, philosophers, or scientific men. The chief drawback to the more intelligent faces is the furtive, stealthy look they sometimes have, which is suggestive of shiftiness and insincerity; but the majority are sufficiently frank and bold-looking—in their own country. The women are for the most part singularly unlovely. Little girls are often quite pretty, but the hard field-work and the exposure to all weather the women have to undergo, makes their complexions rough and dark. They are often also appallingly dirty. You are surprised to notice one day how comely a washed face can look, and then you notice it becoming daily dingier and dirtier, until not unfrequently it ends by being absolutely sooty. Then the poor things too often have a tired depressed look from overwork. They age rapidly, as might be expected.

The physique of the Kafirs is magnificent of its kind. They are light-built men, who almost always seem to be in hard training. Fat men are unknown altogether. One day I was speaking to the chief priest on this very point, and was explaining to him how common fat men were in my own country. He looked at me in quiet surprise for a few moments, then his face brightened in a curious way, and he said, "I know very well what you mean. I once killed a very fine man on the Asmar frontier, and he was fat just as you describe." Very few of the older men in Kafiristan are even what might be called stout. Their average height is between five feet five and a half and five feet six. The tallest man amongst the Kám was six feet one and a half. The

biggest man of the tribe was half an inch lower in stature. He was an extraordinarily powerful fellow; but, as a rule, the men of medium height are not only the most active, the fastest runners, the most enduring travellers, but are generally the most physically powerful also. The women, with some few exceptions, are of low stature. Very many are weakly-looking, yet their powers of endurance are simply marvellous. They often make extremely long marches, carrying loads.

The commonest dress of the Siah-Posh is a goatskin confined at the waist by a leather strap, which also supports the inevitable dagger. This is the commonest dress on the whole, because it is worn by the poorest classes, who are naturally the most numerous part of any community. I have never seen a goatskin garment worn under any circumstances by a woman. The favourite dress of the fairly well-to-do Kafir male of the Eastern valley is a coarse cotton shirt and trousers, a brown Chitrali or a black Minjani robe, brown soft leather boots, and perhaps also footless Chitrali stockings. The national garment, however, is a tunic, which all women wear without exception, and many men as well. It is made of thick dark brown woollen cloth, and in women reaches from the shoulders to the knee; a wedge-shaped piece of the body in front and behind is exposed owing to the peculiar shape of the garment. It is girdled at the waist by a long dark red flat cord about an inch and a quarter broad, ending in tassels. It has a red edging round the bottom; there are no sleeves, but the upper part of the garment is so fashioned that the wearer often looks, if viewed from the front or the side, as if she were wearing an Inverness cape. The men never bind this tunic tightly to the person as the women do, but simply wear it thrown loosely over the shoulders. The Presun people wear very thick loose grey blanketing clothes, which give them a cumbrous, awkward appearance. The Wai people wear cotton clothes, and affect bright colours whenever they can get them. The Siah-Posh women wear square cotton caps at the back of the head, while the girls confine their locks with a double thread fastened round the head at the level of the brows. The official head-dress of the Siah-Posh women is the curious horned cap, of which you will see a specimen in another room. This head-covering is almost invariably worn by the Katir women, but is only used on important ceremonial occasions in the other Siah-Posh tribes. In the Western valleys the fashion is to have the horns much lower than those worn in the Bashgul valley, but in other respects the head-dresses are identical. One of the chief ornaments of these curious horned caps is a number of common brass thimbles. On one occasion I noticed on one of these thimbles a short English inscription, "For a good girl," or something of that sort; and this is remarkable, for it was the only instance in which I met with written or printed characters during my residence in Kafiristan. The Wai women often wear large drab turbans ornamented with festoons of cowrie-shells, and they are

also much addicted to the employment of pretty red and white beads as an additional embellishment to their persons.

Children are always born in a special building on the outskirts of a village. The way they are named is very peculiar. An old woman runs rapidly over the names of the baby's ancestors or ancestresses, as the case may be, and stops at the instant the infant first begins to feed; the name on the reciter's lips when that event occurs being the name by which the child will thenceforth be known during its life. As a consequence of this peculiar custom, it not unfrequently happens that more than one member of a family is compelled to bear the same name. In such cases the children are distinguished from one another in speaking of them by the prefix junior or senior, as the case may be. Kafir men and women are known by their own particular name affixed to that of their father: thus, Chandlu Astán means Astán the son of Chandlu. In the case of very popular names, the grandfather's cognomen has frequently to be employed also to distinguish the various individuals: thus, Lutkam Chandlu Merik means Merik the son of Chandlu, the grandson of Lutkam. Occasionally, though rarely, the mother's name is used along with the father's; so Bachik-Sumri Shiok means Shiok the child of Basik and of Sumri. There is no objection in Kafiristan to a child bearing the same name as its father, as there so commonly is throughout the East; indeed, you constantly hear of Merik Merik, Gutkech Gutkech, and similar instances of father and son bearing identical names.

The most striking mental peculiarities of Kafirs are their extreme cupidity, their extraordinary jealousy of one another, and the intensity of their intertribal hatred. Their cupidity is, indeed, a marvellous sight to witness. A Kafir will come into your house or tent, sit down on a chair or stool, and talk quietly until he begins to cast his eyes round the place. You may then notice in many cases the man's eyes half close, his face flush, and his whole demeanour become an extraordinary example of extreme covetousness. Their jealousy of one another is so great that they are often ready to break out into murderous quarrels even on the mere suspicion that an English traveller, like myself, was giving away presents with partiality. Their intense intertribal hatred entirely deadens their political foresight; and a Kafir tribe is always ready to beg the help of its most inveterate Mahomedan enemy and even introduce him into its territory in order to aid in the chastisement of some other Kafir tribe. Kafirs are quite the reverse of intolerant. At the foot of the Kamdesh hill there are two hamlets, one to the north called Agatsi, the other to the west called Agaru. These tiny settlements are peopled by Kafirs who have changed their religion to Mahomedanism. Their family connections amongst the Kafirs would be just as ready to avenge the killing of one of these renegades as they would be to avenge the blood of a co-religionist of their own family.

The Kafirs are by no means simple in character; they can intrigue, concoct secret plots, and then carry them out with the secrecy and subtlety of the average Oriental. On one occasion a headman of Kamdesh went on a visit to the Amir of Kabul. On his way home, while journeying up the Kunar valley, he was waylaid by some followers of the fanatical priest of Dir and murdered. The man who actually dealt the fatal blow was a Kafir who had embraced Islam. He escaped to Dir, and lived there under the protection of its powerful priest. The headmen of Kamdesh consulted together how the murder should be avenged. Eventually they decided on a plan which shows well the persistency with which a Kafir can carry out a settled resolve. They employed a man to go to Dir to declare himself a convert to Mahomedanism, and to become a follower and disciple of the fanatic who is the head of the Mussulman religion at that place. Their emissary remained in Dir for more than two years before he could, under the veil of friendship and a common religion, persuade the murderer to pay a stealthy visit to Kafiristan, where, of course, he was at once seized by prearrangement and immediately killed. The mental powers of an ordinary Kafir are by no means inconsiderable. I took a lad to India with me who belonged to a poor family, and was of a somewhat degraded type. When we returned to Kafiristan, amongst other presents I handed over to him were some 280 Indian rupees. He begged that, instead of paying him in Indian rupees, I would give him their equivalent in Kabul money. The Kabul rupee is worth twelve and a half annas, while the Indian rupee is worth sixteen. I carefully calculated out the number of Kabul rupees to which he was entitled, and handed them over to him. He at once objected, saying my calculation was wrong. We had an elaborate argument, I appealing to my figures, and he appealing to his fingers and toes, which he used to represent scores of rupees. In the end, he convinced me that he was right and I was wrong. Now, this man was certainly not above the average of Kafir intellect, and he never could explain to me the means by which he arrived at the correct number of Kabul rupees he was entitled to receive. On another occasion I had forgotten the arrangement of letters which enabled me to open a certain puzzle lock. I mentioned the dilemma in which I was to a certain friend of mine—a man who was solely remarkable for his splendid courage and his numerous homicides. He took my puzzle lock in his hand and sat playing with it until he actually found out how to open it, nor did he ever afterwards forget the arrangement of the letters by which that feat could be accomplished. Yet he had never in his life seen a printed letter until I showed him these on the puzzle lock. As a third instance of their remarkable cleverness in many respects; I was showing the priest on one occasion a small conjuring trick, the principle of which, though simple enough, I should have taken many days to discover myself. I had a double tin funnel, which,

when the thumb was placed over the narrow orifice, allowed fluid poured in to rise up into a hidden chamber, where it could be restrained or set free at will by the movement of a finger on an air-hole. The trick was to fill this funnel and its secret chamber with wine, which was then all allowed apparently to flow away. Water was then run through the funnel, which was shown to the people, and finally, the finger being removed from the air-hole, the wine was allowed to escape from the hidden chamber, and the spectators were expected to be mightily mystified. On my showing this little toy to the priest, to try to mystify him in the usual way, he quietly sat down on a stool and ruminated for a few moments, and then looking up, explained that he knew all about it. And so he did; he had thought it all out quietly in a few minutes.

The religion of the Kafirs is idolatry, with traces also of ancestor-worship. Imra is the creator of all things, and there are a large number of secondary deities, both male and female, whom Persian-speaking Kafirs have described to me as "prophets." Of these, Moni appears to be the most ancient, and Gish, the war-god, the most popular. There are a large number of other minor deities, also, who preside over women and children, who must be sacrificed to for wealth, and who give fruitful harvests, etc. Special animals have to be sacrificed to particular gods: thus, Imra receives cows, Gish male goats, Dizani a goddess, sheep, etc.; but we shall only have time this evening to speak of Gish, the war-god. He is believed by the Kafirs to have been created in a miraculous way by Imra. He was a marvellous warrior and slayer of men. They assert that he it was who killed Hassan and Hussein, cut off their heads and then played polo with them, just as the Chitrali princes play the game at the present day. After he died, or rather after he quitted this world, his followers divided into two companies. If you are an Englishman, you will be politely assured that the upper classes went to "Lon-don," and the lower orders settled in Kafiristan. Gish has shrines in every true Kafir village, and the corners of his small temples are not unfrequently ornamented with war-trophies stuck on the end of poles. The object worshipped is either a plain stone, or a wooden head and face carved in a conventional manner. On these the priest casts flour, etc., and the blood of the sacrifice. A great feature in the war system of the Kafirs is the sending out of young men in couples or in small parties, who penetrate stealthily into the enemy's country and there try to waylay, or murder in their sleep, men, women, and children. As soon as they have succeeded in their object, they race back to their village with the utmost speed of which they are capable, being often closely followed up for a part of the distance by avenging Pathans. It is always known when one of these successful raiding-parties has arrived, by the songs of triumph they sing when they halt some little distance from the

village. If they come back in the evening they generally camp outside all night, singing their song at intervals and receiving the congratulations of their friends. In the morning, arrayed in much finery, with dancing-axes in their hands, they proceed to the dancing-platform, and if they have been lucky enough to bring away some murdered man's clothing with them, they cast it on the ground in front of the rude altar, which is always placed conveniently near. Then, in company with all the women of their family, they start dancing in honour of great Gish. In the intervals of the dance the women shower wheat-grains upon the heroes. The music is supplied by drums alone, as pipes must not play at these Gish observances. If a large raiding-party, a small army, sets out and is successful, there is no dancing to Gish afterwards; nor does it ever take place if the fight has been with fellow-Kafirs, nor if any of the raiding-party have been slain. If you wish to compliment a Kafir, you compare him to Gish; while the prettiest thing you can say to a Kafir woman is to call her "Gish Istri," which means Gish's wife. Besides gods, the Kafirs believe in fairies, and also in devils, who have to be propitiated in order that the crops may not be destroyed. I on one occasion, while making some particular inquiries about Yush, the chief of the devils, found that my friends were very chary about describing him to me. The more my inquiries concerned his appearance, the more embarrassed the spokesman became. At last a thought struck me, and I asked if Yush resembled me—if he were of my colour. "Oh no," was the polite and tactful reply, "he is not like you; he is like the private English soldiers in India." It was in this way that I learnt that the Kafir devil is of a reddish colour. There is a hell in the Kafir theology where wicked people burn. It is situated below the ground, and the aperture which opens into it is guarded by a custodian named Aramallick, who permits none to pass him. The spirit of a dead man becomes a shade, a mere shape, like the phantoms we see in a dream. The religious stories told me were mostly of an infantile description, although some of them were undoubtedly curious. As a rule, however, they are most inconsequential. Kashmir is the most sacred place in the world, because it was the first created country. There is a story of how the world was populated from Kashmir which is not without interest. A confusion of tongues came upon a number of brothers and sisters, the children of Baba (Father) Adam and his wife, who were all sleeping together, so that on waking in the morning a man could only understand the speech of one particular woman; so the company told themselves off in couples who could understand one another, and then wandered away in different directions to populate the world.

Wooden effigies, or a long single stone placed on end, are erected to the memory of dead relations, and although ancestor-worship is denied by the people, I have seen these effigies and monoliths sprinkled with

the blood of sacrifices offered by those of the same family who were suffering from sickness, while at a particular festival food is presented to the family effigies, and placed round the house for the use of departed shades.

There are no human sacrifices under any circumstances in Kafiristan, except that prisoners taken in war are sometimes stabbed in front of the coffins to satisfy the indignant ghost of a dead warrior. Kafirs are never melancholy, and suicide is not only unknown amongst them, but when they are told about it they are unfeignedly surprised.

There is nothing in the shape of prayers; the substitutes are religious dances, sacred songs, and sacrifices.

The sacrifices are carried out by the "utah," or priest; the "debilala," the singer of the praises of the gods; and the "pshur," who is supposed to be temporarily inspired on all such occasions; but no goat or other animal is ever killed for food in Kafiristan except in the orthodox way, and with the appropriate ceremonies. At such times any one may officiate.

The priest—the Kamdesh priest is the seventh of his line in regular descent—is a very important personage. He is allowed to sit on the stool in the open air, whether he has gone through the necessary banqueting or not. He is always a man of wealth, and the head of a clan. He gets a double share of each animal whose sacrifice he presides over, and has other rights and perquisites. On the march and elsewhere, he takes precedence of every one. For some particular reason he must not go near the receptacles for the dead, nor even traverse certain paths which lead to those places. Slaves may not approach the hearth of any house he may possess, nor come too near any of the shrines.

The "debilala" is also a man held in high respect; he recites the praises of the god in whose honour the sacrifice is being made, and at the great religious dances in the springtime he has a special place assigned him in the centre of the performers, and alongside of the priest. He also is debarred from using certain pathways supposed to be impure.

The "pshur," is the individual who becomes temporarily inspired during sacrifices and on other occasions, when he frequently behaves most violently, and is sometimes not soothed before some of the headmen have specially appealed to Imra on his behalf. He is on the whole despised by his fellows, who believe that although he is sometimes really inspired, yet at other times he is simply a liar, as they put it in their charmingly direct way. I have watched the proceedings of many of these "pshurs"; those of the inner valley, where there is one to every village, are held in much greater respect than those of the Siah-Posh. I think the majority of these men believe in themselves to a certain doubtful extent. On one occasion, at night, during a visit from the

Kám priest and the "pshur," I gave them some cognac, as a specimen of Western drinks. Shortly afterwards, a quarter of an hour or so, the "pshur" became greatly agitated, turned quite pale, and trembled all over. The priest at once began high-voiced appeals to Imra, but it was a long time before the "pshur" was himself again. The two men did not leave me without giving me all kinds of warnings and cautions. I was not to go to bed till the morning, and I was to be very careful of the kind of food I ate the following day, the nature of which food was particularly mentioned. It appears that while engaged in talking to me, the "pshur" suddenly became conscious that a fairy's head over my doorway was quietly regarding him. The fairy observed that he or she had come from "Lon-don" to inquire if the "Frank" were there, and on receiving what one would suppose was a somewhat superfluous answer, the fairy gradually faded away.

On another occasion, another "pshur" having a bad cough, I shared with him some opium pills I was using myself for a similar complaint. The result of the opium on the man was, that he was terribly possessed during the day, and jumped and shouted and played all manner of antics. He was, I think, partially deranged in his intellect. He was also a terrible homicide. We were on the march at the time, and all the Kafirs we came across appeared to fear my companion greatly, glancing at him with dislike and distrust. The Kam pshur, who, by the way, was a great friend of mine, was disestablished, disendowed, and kicked out of the tribe on the occasion of two young men getting killed while engaged on a raiding expedition. I suppose he had given a wrong prediction, for when the boys' heads were brought in for the funeral ceremonies, he was ordered to clear out at once and return to his own tribe. It appears that the Kám, having no inspired person of their own, had imported this man from the Mádugál Kafirs, otherwise I do not see how the Kám people could have got rid of him. Once I was greatly embarrassed by one of these "pshurs" having, during his period of inspiration at a sacrifice, set all the Kafirs of the Bashgul valley raiding another Kafir tribe with whom up to that date they were on terms of friendship. Besides the functionaries I have described, there are others who perform certain subordinate duties in relation to the gods. For instance, supposing there is excessive snow or rain, the people collect together in some particular house, and that one of the "jast," who alone can perform the ceremony, binds a piece of cloth turbanwise round his brows, takes a bow in his hand, and after purifying it by the sprinkling of water, proceeds to discover which of the gods is willing to receive a sacrifice. He finds this out by rapidly running over the names of the gods until the bow begins to swing backwards and forwards. The name of the god on his lips when the movement begins is the name of the god desirous of being sacrificed to. An amusing circumstance occurred in this connection on one occasion. The god Aram had consented, in the way I have just described, to

accept a goat offered in the hope of stopping the excessive rain and sleet, but the weather began to clear even before the god's name was given out. On that the prudent giver of the sacrifice postponed his offering, in the hope that he might be able to cheat the god of his due. The priest was excessively angry, and told me the weather would grow worse and worse. I could not help smiling at his apparent earnestness, but by one of those curious coincidences which are the stock in trade of all mystic impostors and other quacks, the weather did get terribly bad, and I was nearly drowned out of my house. I remember two other occasions where a sacrifice was immediately followed by the complete cessation of the natural phenomena by which it was directed.

The mode the Kafirs have of disposing of their dead is peculiar. They are not buried nor burned, but are deposited in large boxes, placed either on the hillside or in some more or less secluded spot. In some few places, notably in Lutdeh, these coffers for the dead are placed just above and close to the village, on the level ground and alongside the road. When the wind blows from that particular direction the result is simply appalling. The boxes are very large, and usually body after body is put into them, as long as the wood resists the natural decay due to time and the weather. Certain great men are occasionally, I think, given a box all to themselves. Only in one or two instances have I seen flags placed by the boxes, or pieces of bright-coloured cloth draped on them. The lid generally has several largish stones placed on it, possibly to prevent its warping and exposing the contents of the coffer. Ornaments, silver earrings, etc., and bright-coloured clothing are sometimes deposited with the dead, as are also wooden bowls containing bread broken up in clarified butter. When through age the woodwork decays, the bones of the dead are exposed, and very little attention is paid to the circumstance.

The funeral ceremonies are most elaborate in certain instances. A little girl who died at Kamdesh was dressed in decent cotton grave-clothes, her relations being wealthy people, and the body was simply carried in a blanket by four men to the cemetery without any ceremony of any kind; a string of weeping women followed behind in pairs or singly, the nearer relations being supported by female friends.

The dead wife of a headman, who had herself gone through the ceremony of banqueting the people, was treated with much greater honour. Placed on an ordinary Eastern bed, and decked out with all the finery the family could muster, with festoons of wheat ears to indicate her liberality during life, the body was held shoulder high by slaves, while the nearest female relatives sat wailing on the ground beneath it. One of them—the only daughter—stood with one hand on the bed addressing her dead mother. Then the band struck up, and a curious dancing scene was presented. Immediately round the corpse was a circle of women, who edged round from right to left, giving a funeral gesture

with the hands shoulder high. This gesture is made with the hands upright, the fingers extended. It consists in jerking the hand rapidly, so that the palms are one instant directed towards the dead body and the next towards the performer; its meaning is supposed to be, "she has gone from us." Outside the circle of women was a circle of men, dancing singly, but much more energetically, and also going sideways. They made a similar gesture to that used by the women, except that the hands, instead of being held at the level of the shoulder, were whirled round at the level of the brows. Outside this second circle were ordinary men-dancers, stamping round mostly in pairs with arms round each other's shoulders. In the intervals of the music the bed was placed on the ground; the chief mourner, sitting on its edge, looked into her dead mother's face, and filled the air with lamentations. She could hardly be prevailed upon to stop sufficiently long for one of the tribal orators to shout out breathless staccato sentences praising the dead woman, her liberality, and the family to which she belonged. All the time wine and food were being handed round to all the spectators. Afterwards the band would strike up again and the dancing be resumed, and so on all day. In the case of men killed in war, or when famous warriors die, the ceremonies are extremely elaborate. On one occasion, two youths, friends of mine, were killed in a raiding expedition. As a kindly act to the bereaved families, the heads were cut off by a friendly tribe and brought into the village, being met and received by a great crowd of lamenting women. The fathers of the poor boys simultaneously cast themselves from their housetops, injuring themselves severely. Straw figures, gorgeously clothed, were attached to the heads, and each on a separate bed was taken to the dancing-platform, where dancing, orations, etc., were continued for two or three days. Then the heads were placed in the boxes in the cemetery, and further observances were carried on with the straw figures alone. Each villager on arriving on the platform invariably went through the action of kissing the dead about a yard off. Large quantities of food and wine were distributed continually. When the throng went away to rest, the figures were consigned to the charge of the women, who sobbed out adjurations to the dead, while at intervals wise old women one by one chanted their genealogies. The orations were made most dramatically. The speaker would step forward to the foot of the bed to gaze an instant at the dead faces, then cover his own face with his mantle and burst into sobs and tears. He would begin addressing them by name in a broken voice, until, recovering himself, he would eloquently praise their bravery, their manliness, as worthy of the families from which they sprung.

A famous warrior died in a distant village while I was at Kamdesh. The corpse was brought in sad procession to Kamdesh, preceded and followed by weeping women. A large number of guns were fired off, both by men in the procession and the men of the village, and the

firing was continued on subsequent days. The ceremonies were much the same as those for the young men, only more elaborate. After the body had been committed to its last resting-place, the following day its straw effigy, lashed to a bed, was danced violently round and round, or shaken violently up and down in time to the drumming and the stepping of the dancers, who honoured themselves and the dead by a display of extraordinary agility. Warriors arriving at intervals during the dance deposited for a time their shields on the bed by the effigy, to indicate their respect for the famous fighter.

After a death the house is purified by water, but the priests will not enter it until the wooden effigies of the dead have been erected. This is done after an interval of a year. These effigies are of all sizes and of various degrees of magnificence, according to the wealth of the deceased family. A very large fine effigy necessitates the feeding of the whole village for several days, while a simple flat affair may cost one banquet only. At the time appointed the wooden figure is carried to the dancing-place, and, if not too heavy, is itself danced on the back of a slave. There is an inner circle of women, who dance round it sideways, and use a certain gesture with the hand held breast high. The hand is half bent, palm upwards, and alternately pointed in a half-circular sweep, first towards the effigy, and then back again towards the performer. This gesture is supposed to mean, "As he or she now is, so shall I become also." Of the other dancers, the men, who are entitled to the privilege, deck themselves out in their most gaudy raiment, while flags are also carried round and round in the moving throng. In one instance a bowl was twirled high by one of the women, to indicate that the deceased—a woman—had been most liberal during her lifetime in giving feasts. Some of the sights seen during funeral observances are highly fantastic. Such, for instance, as a sobbing man, the tears running down his face, yet dancing and capering most energetically.

There are no blood-feuds amongst the Kafirs such as those so fatally common amongst their Afghan neighbours. The penalty for killing a fellow-tribesman is, however, extremely severe. Kafirs are continually quarrelling amongst themselves, and the danger to his family of one man killing another is so well recognized and understood, that men, women, even children, are prepared at all times to throw themselves recklessly between the combatants and try to separate them. It is considered an act of virtue to do this. In these incessant quarrels dagger-wounds are very common, but they are almost invariably inflicted on the hands of those who are trying to separate the quarrellers, and who rush between fighting men with the greatest intrepidity. If a Kafir kill another, he must at once leave his village and become an outcast. His house or houses are burnt by the dead man's family or clan, and his property plundered. He must nevermore return to

his native village except by stealth, and whenever he encounters any member of the dead man's family, he is obliged at once to hide himself in bushes or behind doors, etc. The stigma applies not only to the man, but to his direct descendants and to his children in law. There are several villages which may be called cities of refuge in Kafiristan, where slayers of their fellow-tribesmen reside permanently. They can only be released from their outcast condition by paying down a heavy ransom to the dead man's family. The ransom is so heavy that it is very rarely paid. Indeed, to pay it shows so much wealth and honour, that the man himself and his descendants, when they return to their village, always afterwards carry a specially shaped axe to indicate their social importance. Concerning this question of men killing one another, I have frequently asked Kafirs what would the result be if a man were to slay a fellow-villager while defending his own life from an attack? The answer was invariably the same. The homicide —justifiable homicide as we should call him—becomes at once a "chile," that is an outcast. On my attempting to argue the justice of this, they always made the same reply: the man should have defended his life without killing the other man. This way of avenging a murder is extremely suitable to the small Kafir communities, where the life of every single man is of the utmost value as a factor in the fighting strength of a family or a tribe. For it is obvious that if the custom, "a life for a life," prevailed, the tribe would lose two fighting men instead of one whenever a man was killed in a domestic or village quarrel.

There is little or no ceremony about a Kafir marriage. A man who is enamoured of a young woman, or wishes to get married, sends a friend to the father of his would-be bride and asks her price. It is nothing more than that. If he is an ordinary poor man, he will have to pay eight cows, while if richer he may have to give as many as twelve or sixteen. If the father entertains the proposal of the suitor, he sends back word to that effect, and the man immediately goes to the woman's home, where a goat is sacrificed, and that constitutes the whole of the ceremony. They are then considered married, but the woman remains in her father's house and works for her father only, until the last penny of her price is paid by her husband. Divorce is easy. It appears to simply consist in a man selling his wife to some other man. Kafirs are polygamous, and usually have from one to four, or at the utmost five, wives. When a man dies, his wives revert to his family, and are either sold or retained by his surviving brothers.

I regret that the time at my disposal has not permitted of my entering into more details concerning the manners and the customs of these interesting people; that I have been unable to describe their domestic life, their slaves, their villages, their houses, their shrines, and particularly that I have not been able to give you a description of

the curious inner Kafiristan valley, where there is a great temple to Imra famed throughout Kafiristan—a mysterious hole in the ground, to look down which means certain death to any one, and a wonderful iron bar and sacred stones, which were placed in their present position by Imra himself! In that valley the Kafir houses, instead of being raised two or three stories above ground, descend an equal distance below the ground. There everything appears to be even more strange, fantastic, and unreal than in the Bashgul valley, which always lingers in one's memory as a "faëry lands forlorn." When I first went there I almost believed I had at length landed on Sir John Mandeville's Valley of the Devils; but the people are singularly interesting, and if it cannot be honestly affirmed that truthfulness and frankness are their special characteristics, they are at any rate far more truthful and honourable in their dealings than their immediate neighbours. They have strong family affection; they are devoted to one another in war, and are capable of performing the greatest acts of self-sacrifice, especially in fighting, where I have known a youth, little more than a boy, deliberately stop behind to help a wounded friend, with the absolute certainty that he would himself be killed. He was killed, and to the credit of the Kafirs it may be said, that no one of the tribe expressed the slightest surprise at this act of self-devotion.

Kafirs are naturally boastful, and in their anxiety to impress a stranger with their bravery or their importance in the tribe, do not hesitate to utter splendid mendacities. Most of the early information given me was false from beginning to end, and I still grudge the labour involved in recording it. Yet they are a brave, independent people, who have maintained themselves for centuries against hordes of enemies, not only by reason of the extraordinary difficulties their country presents, but by valour and their magnificent fighting powers. They are entitled to the respect every one must feel for real men, who will fight to the death rather than accept the yoke of the stranger.

Before the reading of the paper, the PRESIDENT said: We are assembled this evening to hear a paper by Mr. Robertson on his journeys in the interior of Kafiristan. Many of us remember the deep interest taken ten years ago in the paper read at that time by Mr. Macnair, who had penetrated to the borders of Kafiristan, and we are very glad to see here present this evening Lord Aberdare, who was President on that occasion. We remember, also, the interest that was taken in the discussion kept up by Sir Henry Yule and Sir Henry Rawlinson, and others learned in everything concerning that part of the world. Unfortunately, we have not present here so many officers as we had then, who are conversant with the question. Sir Peter Lumsden is in Scotland, and I am sorry to say my old comrade and tent-mate, Sir William Lockhart, is also, to his very great regret, unable to be present this evening. We have, however, present with us Colonel Tanner and one or two others.

After the reading of the paper, the following discussion took place:—

The PRESIDENT: The presence here this evening of our old President, Lord Aberdare, reminds me that ten years ago the late Mr. Macnair conducted us to the very threshold of this region, and introduced us to some Kafirs who I find now are not the right sort. Possibly Lord Aberdare may care to remind us of what we learnt that evening; if not, I will ask Colonel Tanner to tell us something of his attempt to reach the land of the Kafirs.

Colonel TANNER: I am a kind of failure. Mr. Robertson succeeded in penetrating and seeing the greater part of this country; I have never been there at all. However, as I have been on the west and the south, I can say a very few words of what I did see on the west when accompanying Sir Samuel Browne's field-force. We penetrated to the Lughman valley, where the whole of the Kafiristan mountains, deeply clad in snow, appeared in our front, distant about two days' march, enticing to look at, but of course, being in an enemy's country, none of us were allowed to go there. On another occasion I came back from Jellalabad in disguise to Aret, a semi-Mohammedan country on the borders of Kafiristan. Unfortunately, here I fell sick and had to return, and that is all I have to say about myself. I would refer to the account of Captain John Wood, who penetrated many years ago to the source of the Oxus, and while at Faizabad came several times in contact with Kafirs. For a great many years Captain Wood's account was all we possessed, until Mr. Robertson appeared before us to-night. Very little trustworthy evidence has been forthcoming about this interesting people, and I congratulate Mr. Robertson very much on the paper he has read and the beautiful pictures he has shown. I hope Mr. Robertson will receive your heartfelt thanks for having performed such a very perilous journey.

The PRESIDENT: I can only again express my regret that we have not among us this evening Sir Peter Lumsden and Sir William Lockhart. They could have told us of what they knew of the Kafirs, the one having accumulated much information in 1867, and the other having actually penetrated into Kafiristan for a short distance; but Mr. Robertson has opened to us an entirely new country. I remember that Sir Henry Yule said, on the occasion of the reading of Colonel Tanner's paper, when Kafiristan had been explored the Geographical Society had better shut up its doors. But I maintain that that is far from being the case. Many countries in all parts of the world are entirely unknown to us. The existence of Kafiristan has been known since it was first mentioned by Major Rennell in his 'Survey of Hindustan,' more than a hundred years ago. It was supposed to be inhabited by people of great interest, more or less descended from some of those Macedonians brought into Central Asia by Alexander and his successors. Mr. Robertson has, in the tea-room, a vase or utensil of some kind which has a Greek inscription on it; and I remember that Mr. Macnair picked up, in a ravine to the south of the Kunar valley, a gem of some kind which Sir Henry Rawlinson pronounced to be Babylonian, and which was almost certainly left there by some soldier in the army of Alexander the Great. These theories and ideas have always given an intense interest to this country of Kafiristan. Therefore, I think you will heartily join with me in a vote—and most cordial vote—of thanks to Mr. Robertson for having opened this country to us, and having given us an exceedingly interesting account of its inhabitants.

ON THE RIVER TELUBIN.*

By HENRY LOUIS, A.R.S.M., F.G.S., etc.

THE least-known portion of the Malay peninsula is the north-eastern angle within which lies the principal part of what are known as the Siamese Malay states, a number of semi-independent Malayan states tributary to the King of Siam; of all these little known states, the least known is perhaps that of Telubin, or Sai, which was till quite recently an unknown name to European geographers. Attention was first directed to it some years ago, when an American vessel foundered off the mouth of the river Telubin, and the sailors who managed to reach the shore were hospitably received by the Rajah of Telubin, and ultimately sent back to America in safety. It has also been known for some years that at a place in the interior, presumably near the headwaters of the Telubin, there were a number of rich gold-mines worked by a colony of Chinese. Several attempts were made by Europeans, and within the last few years in two cases, at any rate, with success, to reach these mines, but on both these occasions an overland route was adopted. The river Telubin thus remained unexplored, and I have every reason to believe that no Europeans had ever ascended or descended this river previous to the time of my expedition. Although my object was not directly geographical, but was simply the investigation of the above-named mining area and others not far distant from it, yet the fact of my traversing an extensive range of country that no white man had hitherto penetrated, induced me to carefully map my route and the salient features of the country as far as the thick jungle, with which it is everywhere covered, would admit of. In the present paper I shall, of course, only attempt to give the geographical results thus realized, without reference to the mining matters which were the immediate objects of my expedition.

In the first place, a brief account of the history of this country may not be without interest. At various times the Siamese overran and conquered the entire Malay peninsula, even as far, it is said, as Singapore, and the rulers of most of these Malayan states were tributaries of Siam; yet in these states their rule was never so firmly established but that their turbulent Malayan subjects were constantly revolting against it. Ultimately, it would seem that all the Malayan states south of about lat. 5° N. became independent of Siamese rule, whilst those on the northern side of the great east and west mountain range that crosses the peninsula at about this degree of latitude remained tributaries, yet with a large measure of independence. The Siamese dominions proper then extended, and still extend, as far as the isthmus of Kra, and on the southern portions thereof the Siamese were constantly engaged in petty

* Map, p. 288.

conflicts with the brave and warlike Malays, who were their titular subjects. Up to that time (before 1800), the north-eastern seaboard was occupied by three great Malay sultanates, namely, Patani, Kelantan, and Tringganu. The Sultan of Patani, then probably the most powerful of the three, made attempts at various times to throw off the Siamese yoke; there was one in about 1775, and a final one apparently about 1820, when, by pursuing their usual policy of fermenting internecine disturbances and calling in the assistance of other Malayan states, the Siamese, although far inferior to the Malays in physique, courage, and fighting qualities generally, thoroughly subdued the Patani Malays. Very many of the inhabitants were carried off to Siam and forced to settle there, forming considerable colonies on the Klong Kut Mai, not far from Bangkok. At the same time the state of Patani was split up into a number of smaller states, the new state of Patani thus formed being one of the smallest. The other new states, thus created, are Tojun or Nongcheh, Jambu or Jering, Telubin or Sai, Jala, Lege, and perhaps also Tiba, although I am doubtful whether this state and the powerful inland state of Reman ever formed part of the old state of Patani; the latter, at any rate, seems probably to have had an independent existence before the time of the division. The curious semi-independent Chinese state or colony of Tomo or Hulu Sai (the headwaters of the Sai or Telubin), which is still in some respects looked upon as forming a portion of Lege, must also be included in the above list.

It is a curious and noteworthy fact that the Siamese, the least warlike to all appearance of this group of nations (not even possessing a national weapon), have succeeded in the long run in defeating, and even in most cases in retaining a mastery over the various nations that border upon them; they seem to most thoroughly realize the value of the classic maxim, "Divide et Impera." As regards the Malayan states, the Siamese have fairly consolidated their power; all the smaller states above mentioned, as well as the larger ones of Kelantan and Tringganu (together with several others, such as Keda, on the western side of the Malay peninsula), are now tributary to Siam, paying a triennial tribute. These states are administered by a viceroy, the Chakun of Singgora or Songkhra, the town of which name, admirably situated, was founded and fortified by the Siamese king, Fia Tak, about 1780, and is now practically the capital of the Siamese Malayan states.

In my map I have indicated as well as possible the boundaries of these various states, my knowledge of their position and direction having been gathered from the statements of the native chiefs and authorities. Where so much of the country is dense jungle, unexplored even by its Malay inhabitants, the precise location of a boundary is as impossible as it is unimportant. All Malay villages are on the banks of rivers, and, as long as they know to which rajah they owe tribute and allegiance, the question of inland boundaries does not trouble them. The worst

that could happen would be that tribute might be demanded by the wrong chief; and as this would probably lead to a little promiscuous fighting and marauding, with perhaps the killing of a few Chinamen thrown in, it may be surmised that the average Malay would not regard it as an altogether unwelcome interlude, seeing that the Malay loves fighting as much as he hates work, and that it is not by any means an unusual thing to find a perpetual feud subsisting between neighbouring villages or districts, which, even when smouldering, needs but the slightest breath to fan it into active flame. All the rajahs of these Siamese Malayan states have to renew an oath of allegiance to the King of Siam twice a year in certain specified places, this oath taking the form of drinking water in the presence of certain priests and officials, either personally or by proxy, whilst they also have to pay triennial tribute in the shape of a tree of gold. These trees are of various sizes, between one and three feet in height, very neatly made; the stem and branches consist of stout gold wire, to which the leaves, made of thin plates of gold, are fastened. Their value is not very great, as I estimate the weight of the largest one I have seen at about twenty ounces; but they are always accompanied by tribute in kind in the form of gold, buffaloes, elephants, etc., the value of the tribute being proportioned to the importance of the contributing state; it is probably somewhere between $5000 and $15,000 for each state paid once every three years This tribute has to be sent to the viceroy, the Chakun of Singgora, whose duty it is to transmit it to the King of Siam.

The reason, apparently, why the tribute takes this shape is that most of the transactions in this region are still carried on by means of barter. Such currency as there is, consists of old Spanish and Mexican silver dollars, which have been introduced by the ubiquitous Chinese, who are settled and carry on trade in all parts, and of small coins known as "pitis," coined by the rajahs of the respective states. Specimens of these coins are here shown. They are made of an alloy of lead and tin, about the origin of which I shall have something to say later on. They are cast in stone or iron moulds, and their value varies in different states from 1280 to 960 to the dollar. I always had the greatest difficulty in getting the natives to accept either the Japanese yen or the Straits Settlements fractional currency, and, in fact, it appeared to me that it was only the Chinese settlers who had any idea at all of the value of these latter coins.

Of all the above-named district my explorations were directed principally to the Telubin valley, although I also traversed some portion of the valleys of the Menara and the Kelantan on the east, and the Patani valley on the west. The Patani valley is fairly well known, owing to the fact that an English company was working a mine of silver-lead some distance up this river about a dozen years ago; there was a comparatively large staff of Europeans engaged at these galena-mines (which had ultimately to be closed down), and in consequence the river Patani

has been fairly well mapped. In the course of my journey I made a few additions to our knowledge of the geography of this valley, but most of my map is taken from the careful surveys of it made some years ago by my late partner, Mr. H. M. Becher, who, it may be remembered, unfortunately lost his life in attempting to penetrate into the unknown country on the south-western borders of Tringganu.

I started from Singapore on the morning of the 16th of August, 1890, in a steamer bound for Bangkok, but which had arranged to go out of its course so as to take me and my expedition to Singgora. I had with me two European assistants, one of whom was an excellent Malay scholar, and two Chinese servants.

We reached Singgora at 4 p.m. on the 18th, and slowly worked our way to a safe anchorage inside Pulo Tikus; with some difficulty we managed to get boats from Singgora to take us ashore. The town lies on a narrow promontory that juts out northward from the mainland, enclosing a very extensive bay, which is almost completely land-locked by it, there being only a small and very shallow channel between this bay and the open ocean, the average depth of this channel being probably under six feet. Steamers accordingly cannot enter this bay, which is not even accessible to tongkangs (native boats) of any size.

Singgora has been repeatedly described, as it has been several times visited by Europeans. It is only distant from Singapore some 500 miles, and is a typical Siamese town. On approaching the shore, there is an excellent landmark in the form of a Siamese temple, or "watt," which occupies the summit of an isolated conical hill close to the town, known as Tan Kwan. The "watt" is reached by a good flight of stone steps up the side of the hill; halfway up there is a small paved plateau, where another "watt" is now being erected under the orders of the King of Siam, the original temple being about thirty years old. It may interest navigators to know that I roughly determined the height of the apex of the "watt" as 350 feet above sea-level; it has the usual shape of a small square building, surmounted by a spire tapering to a fine point. This hill, crowned with the white spire of the temple, makes an admirably conspicuous landmark, visible far out at sea.

The town of Singgora proper is enclosed by a wall of rubble stone, laid in lime mortar, some 15 feet in height. The space enclosed by it is a rectangle about three-quarters of a mile long, and say one-third of a mile wide; only a portion of this space is occupied by houses. The wall is pierced by several gateways, the principal one being a very handsomely built and massive stone frame, with wooden doors quite 25 feet in height. On that side of the wall which faces the inland bay already referred to, some half a dozen guns, in an advanced stage of decomposition, propped up by crumbling wooden carriages, are mounted. As old iron their value is somewhat problematical; in all other respects it is nil. Fortunately, no one seems to have the most remote intention

of firing them. The chakun's palace is enclosed by a wall, which forms a continuation of the walls of the town, and lies at the north-west angle of the enclosure. Just in front of it is the court of justice, in which sits, during stated hours, the governor or his deputy, in order to hear complaints and administer the law. Close to this, again, is a thatched building forming the police station, whilst immediately opposite a large gang of convicts, heavily ironed, were at work building a new market-place. They were probably kept at work in this particular spot as a salutary warning to all would-be law-breakers, but I could not help thinking that justice administered to the inharmonious accompaniment of clinking manacles might possibly be somewhat harsher than it would be under more genial influences.

The principal street of Singgora runs for nearly the whole length of the walls close to the front abutting on the bay. It is of beaten earth, cemented, and is lined on either side with good shops and houses built of bricks, plastered, and tiled. The architecture of the town is of the usual Siamese type, modified by an infusion of a distinct Chinese element. At the lower or southern end of the town are some houses built of mud and bamboo, with "atap" (palm thatch) roofs, in the usual Malay fashion. These shops are kept for the most part by Siamese, and some few by Chinese, the principal articles exposed for sale being small hardware goods, cloths, and eatables, most of which, whether of European or Chinese production, are imported from Bangkok. At right angles to the main street are cross-streets leading outside the city wall, which is pierced by numerous gateways. Running closely along the outside of this wall is a narrow street between it and the bay, consisting of small Chinese houses and shops for the most part. It is in this street that the bazaar is held every afternoon, and the motley crowd that throngs it is perhaps the most interesting sight in the place. The bulk of the people are, of course, Siamese in their gaudy silks, Chinese in their invariable costume, a fair sprinkling of Malays (very few of whom seem to be of pure Malayan origin), and an occasional Kling or Arab, whilst here and there Siamese priests, in their curious saffron-coloured robes and close-shaven heads, are seen stalking through the crowd, every individual of which is bargaining away as though for dear life at the top of his voice, excepting only the priests. These priests receive no salary, are never allowed to be in possession of any money, and live entirely upon charity, going round every morning from house to house to collect contributions of food from the inhabitants of the town (irrespective, apparently, of the nationality of the latter). I estimate the entire population at some 5000, but it is difficult to arrive at even an approximately accurate idea. Singgora is said to have existed during the reign of six Kings of Siam, so is by no means an old town, though now a very thriving one. There are a large number of houses outside the town, lining the shore of the bay. Beyond this, and

close to the point of the landspit on which Singgora stands, is a small fort, looking like a little Martello tower, nearly hidden amongst Casuarina trees. I could not, however, see that there was any artillery in this fort, although it is evidently intended for that purpose.

The great bulk of the inhabitants are Siamese; next in importance come the Chinese, who all speak Siamese fluently. In fact, Siamese is practically the only language spoken here, there being very few that understand Malay. A large trade is done with Bangkok, the principle articles of import and export being padi, some little live stock, dried fish, damar, birds' nests, and other native products. Singgora is the main collecting and distributing station of this part of the world for the products of the Siamese Malayan states, and tongkangs are constantly engaged in going between it and Patani, Kelantan, and Tringganu.

There are no manufactures carried on here of any importance, except by a small colony of Chinese gold and silver smiths, who seem to supply many of the neighbouring states.

I had hoped to find the Chakun—the Siamese viceroy—at Singgora, but he was absent on a tour through the Malayan states, so I had to go on to the nearest place to where he was, namely, to the mouth of the Telubin river, by sea. With considerable difficulty I hired a Chinese boat with a crew of four men to take my party and myself—including, of course, all our stores and supplies—to the Telubin, which was to be the real starting-point of my expedition. Although the distance is by no means great, it took us forty-eight hours before we anchored in the mouth of the Telubin. This river has, like most others on this coast, a rather formidable sand-bar, and it is not a very easy matter to enter it; of course, in the north-east monsoon it is an impossibility.

The present capital of the state of Telubin, or Sai, known as Selindong Bayu, the residence of the Sultan of Telubin, is about a mile from the mouth of the river. It consists of an irregular assemblage of native bamboo houses, built in the customary Malay style, and seems to do very little trade of any kind. It is almost hidden in groves of cocoa-nut palms, the fruit of which, together with padi, which is extensively cultivated, are apparently the only local productions.

I spent several days here in examining the surrounding country, and principally in investigating the course of the Telubin river, which is a very curious one, and exhibits distinct proofs of the geologically recent origin of the present coast-line, while the sea is gradually receding, the whole being an excellent example of a delta in process of formation. In the first place, the river splits into two distinct branches, some 15 miles from the coast, each of these branches having its own separate mouth. The Telubin proper is the northerly one, the more southerly one being the Sa, or Sai. The latter used, till some fifteen years or so ago, to be the more important one, but about this time its mouth silted up so much that only canoes could cross the bar; upon this the

rajah transferred the site of his capital to its present position on the northern mouth. These two branches are also connected by another branch, which runs approximately parallel to the sea coast and not far from it, and there are other minor streams branching off in all directions, forming a regular network of waterways, all of which can be traversed by canoes. Their value to the natives is thus incalculable, and it is difficult to see how communication could be carried on were it not for these convenient watercourses, as all the country is under water during the wet season, and there are scarcely any elephants in the state. These animals form the only means of land transport, capable of carrying loads through the swamps which abound in every direction. The few elephants there are, belong to the rajah, who is, however, not above hiring them out for a handsome consideration—at any rate, to Europeans. The Malays here being practically amphibious, and passing fully half their lives on or in the water, it happens that the entire population is confined to the banks of such rivers as these skilful boatmen can navigate, and whenever a Malay cannot paddle his canoe up or down a stream, it will be quite shallow enough for him to walk along its bed, so that its utility as a roadway remains unimpaired. One consequence of intercommunication being practically confined to the rivers is that there is comparatively little need for elephants; these are, accordingly, not kept in a state of complete domesticity as in India, but are always half wild. Caught-young, they are tamed by a very rough process, in which noise seems to form the principal element. The unhappy captive is tied up to stout posts driven into the ground, and then the rajah sends a troupe of his actors and actresses, all of whom are slaves of the rajah, and a ceaseless performance, accompanied by a chorus of shouts, and by music produced chiefly by beating drums of various sizes and by knocking two sticks together rhythmically, is kept up day and night for some weeks. It was once my misfortune to be lodged in the house of a rajah's prime minister whilst an elephant was undergoing the above taming process, and of course such an important operation had to be carried on under the surveillance of this high official, and therefore conveniently near his house. I can only say that it may (and does seem to) tame elephants, but it will nearly drive a European mad. During this time the mahout who is to have charge of this particular elephant, attends on him and feeds him until the beast gets to know him well, and ultimately the elephant is broken in sufficiently to be put to work together with the others. Then, when there is no more work for them to do, the herd is turned into the jungle, their mahouts keeping, however, near them, and being ready to hobble them should they try to wander too far. As a rule, however, they keep to one patch of jungle, in which their keepers always know where to find them. In consequence of these long intervals of rest, during which they practically relapse into their savage state, these Malayan elephants are never

thoroughly tame, and are frequently vicious, so that riding them is by no means a safe or an easy mode of journeying. It is, however, the only possible one when it becomes necessary to travel in any direction where there are no convenient rivers.

Before leaving the river system of the Telubin, I ascended a small branch of it, known as the Bigor. This stream, which is about 15 miles long, takes its origin in a small range of granitic hills, which rise out of the plain to a height of perhaps 500 feet. It is probable that this granite contains disseminated cassiterite, as there are alluvial tin workings at the foot of these hills in the headwaters of the Bigor river, the district being known as Klabar. The tinstone occurs here in small patches of gravel on the banks of the streamlet, lying on a granitic bed-rock, and is worked in an intermittent, shiftless kind of fashion by the natives.

Klabar is a very small state, the population being said to be about 500. It is not under the control of the rajah of Telubin, but of a separate chief, a Siamese. Most of the inhabitants are Siamese, or of Siamese descent, and most know very little Malay. There are also a Siamese "watt" and some Buddhist priests; in fact, it is a little Siamese colony, which has probably been established here as a kind of outpost for political purposes.

After thoroughly exploring the delta of the Telubin, I proceeded on elephant-back to the capital of Lege, a place known as Tanjong Mas. On the road we passed through a Malay village, known as Jeringo, which had at one time been the capital of the state of Sai. There are here the remains of an old brick-built palace, which must have had at one time a rather fine gateway. It is said to have been left by the present rajah some twenty years ago, and is now in a state of extreme decay. It must not be forgotten that in this tropical region, with its heavy rainfall, and with a population who have no idea of erecting any permanent structures, years do as much in reducing a building to ruins as would centuries in Europe.

Jeringo is close to the boundary of the state of Lege, and as a consequence the Lege people are frequently in the habit of making incursions into their neighbours' province for the purpose of stealing any of their goods that they may come across, and more especially their buffaloes. Accordingly, the Jeringo men always keep their buffaloes which form practically their sole possessions, underneath their houses—which are, like all Malay houses, built on piles from five to eight feet in height—after nightfall. The stench and filth of this miserable village as a consequence of this practice are something indescribable. It is no wonder that the inhabitants are—as I saw before I left this part of the world—continually subject to epidemics of small-pox, that play fearful havoc with the population, at times absolutely depopulating whole districts. I have been through villages where there was not a

single house but had one or more of the family struck down by this disease, and have seen others deserted completely, not a single inhabitant being left, the few survivors having apparently migrated to some other spot.

All the Malays in this part of the country have a great reputation as valiant fighting men, and are extremely skilful in handling the kriss. They are also accomplished "caterans," as the following anecdote will show. On one occasion I wanted a blacksmith, who had a great local reputation, to show me how he tempered his krisses.* He consented, and prepared to go to work, and the first step consisted in his helper toilsomely dragging the anvil out of his house to his smithy, which was only some twenty yards away. On my asking why he did not keep his anvil in the smithy, he said that he couldn't, because some one would be sure to steal it if he did!

I must, however, say that I never missed anything during the whole of my expedition, although many articles must have proved a sore temptation to the Malays; I have found them as a race trustworthy, and extremely loyal to their employers when fairly treated.

In the Jeringo district I was told that we were the first white men who had ever been there, and the inhabitants evinced the most intense curiosity in us and our belongings, and the same may be said of most of the other stopping-places on our route.

On our arrival next day at Tanjong Mas, we found that this miserable village was in a state of unusual excitement, owing to the presence of large numbers of Malay chiefs and their retinues who had come to wait upon the Chakun of Singgora, who was making a tour of inspection through the Siamese Malayan states, and had just then got as far as the capital of Lege.

Of Tanjong Mas itself there is very little to be said. It lies on the banks of the river Menara or Benara (?), which here splits into two branches, and, although fully a day's journey from the coast, is still navigable for river-boats carrying up to three tons burden. The village is situated in the midst of an extensive flat swampy plain, the cleared portions of which are entirely devoted to the cultivation of padi, this industry forming the sole occupation of the inhabitants. It is a miserable little village, in a state of extreme squalor and poverty. The previous rajah had been a cruel and rapacious ruler, but a man of considerable power and influence. He had only recently died, probably from the effects of poison, which appears to be not unfrequently resorted

* The above-mentioned tempering is done as follows: The blacksmith covers the blade of the kriss with a thin coating of clay mixed with water to a creamy consistency, dries this coat over his fire, and then heats the blade red hot, the forge being a small charcoal fire blown by a wooden blowing-machine of the usual Chinese type. The red-hot blade was then thrust vertically into a piece of bamboo filled with strips of palm leaves soaked in water.

to by the Malays as the sole available means of tempering the despotic rule of their rajahs when the yoke of any one of them becomes too severe to be bearable, and at the time of our visit his successor had not been definitely appointed; the Chakun of Singgora was at that time in Tanjong Mas, occupied in settling this matter, and apparently having great difficulty in reducing the condition of anarchy and internal dissensions, under which the state of Lege was suffering, into anything like order. The Chakun is a man of considerable ability and force of character, intelligent, cultivated, and, strangely enough, a good mechanic. His brother, who acts under him as second viceroy, has travelled a good deal in Europe, has some knowledge of English, and is an able man. The administration of the Siamese Malayan provinces is on the whole very good and suitable to the people—more so, possibly, in some respects than our own in the British protected native states—and reflects great credit on the Siamese. Indeed, these provinces seem to me to be better administered than Siam proper.

From Tanjong Mas we started on elephant-back for the headwaters of the Telubin. Our route lay about south-south-east, at first over the plains, following up the course of the river (here called the Tanjong Mas), until after some five hours we began gradually to ascend, being then 230 feet above sea-level. The entire journey lay through the densest jungle, so that no distant views could be obtained except at two or three spots where small clearings had been made, or where there were tiny villages consisting of a few Malay huts, in one of which we passed the night. The next day was practically a repetition of the former one, the route skirting apparently the base of a range of hills which are probably about 1500 feet high; our road, however, continued still at about the same elevation, namely, 200 to 300 feet above sea-level. After two days more of this work (elephant travelling being terribly slow, say 12 miles per day), we crossed the range at a pass known as Den Propo, the highest point of which was about 1150 feet above sea-level. Up to this point nothing had been visible of the geology of the country, except sands and clays, with but little gravel, even the beds of the streams being sandy, and showing nothing but fine granitic *débris*. Even on the hill itself no rock *in situ* was visible, except a deep red, very tenacious clay; there were, however, numerous boulders, which consisted principally of granite (some of it porphyritic), gneissoid schists, and highly metamorphic brown and grey slates.

The pass of Den Propo is on the flank of a hill known as Bukit Rusa, which forms a conspicuous landmark from several neighbouring clearings, and is probably quite 1800 feet high.

After crossing the Den Propo pass, our road lay partly along the banks, but more often in the bed of a small stream, the Sungei Mambong, an affluent of the Telubin, which we followed, and soon came to the river Telubin itself, here only a small stream.

We first struck the river at a small village known as the Chukai, a Malay word for a custom-house, this being one of the points where duties and taxes have to be paid to the Chinese headman, who is really a rajah ruling over the Hulu Telubin or state of Tomo, subject in some respects to the rajah of Lege, though in most matters only directly to the Chakun of Singgora.

In the neighbourhood of Chukai there have been very extensive alluvial washings for gold, and indeed a little gravel-washing is still being carried on by Chinese. From a point a few miles higher up, namely the small Chinese village of Hulu Sai, right up to and just beyond the village of Pacho, the river-banks have been worked almost continuously for alluvial gold, whilst at the villages of Pacho and Tomo gold quartz is being mined by the Chinese. The methods of conducting these operations have already been described by me in detail ("A Chinese Method of Gold-milling," *Trans.* Amer. Inst. Min. Engrs., 1891). The history of the origin of gold-mining in Tomo is quite legendary; according to one account given me by an old Malay, gold was first worked by an apparently superhuman tribe of Sakei with white blood who lived on gold. It seems that the Malays worked gold here for centuries, probably before the Chinese made their way into this country, and commenced systematic operations. The existence of gold in this spot is the *raison d'être* of its flourishing and powerful Chinese colony, the population of which must be at least 2000. They first entered the country about two centuries ago in small bands, and commenced to work gold through the sufferance apparently of the Malay rulers of this district. Every now and then the Malays, with the connivance, certainly, if nothing more, of their rajahs, would arrange raids upon the small scattered Chinese communities, and kill all they could come across, the rest taking to the jungle, whilst the Malays carried off all the gold they could find as a legitimate recompense for the trouble of the expedition—danger there was none, as the Chinese appear never to have attempted to show fight. With characteristic pertinacity the Chinese returned, however, to these rich deposits in ever-increasing numbers, until they became too important a factor in the population of the country to be killed off casually as before. Meanwhile one of the principal men amongst them had succeeded in getting himself appointed ruler over all this gold-bearing district by the King of Siam, paying heavy tribute for that privilege, and the Chinese colony gradually organized itself upon its own national lines, forming a most orderly and hardworking community. Some seventy years ago, the greater portions of the richer alluvials appear to have been almost worked out, and the Chinese then commenced to turn their attention to the reefs of gold quartz which occur plentifully throughout a small but well-marked district. Geologically speaking, it consists of highly metamorphosed schists and slates, which are occasionally seen overlying

or penetrated by masses of apparently eruptive granite, this granite being quite distinct lithologically from that which carries tin nearer the mouth of the river. On account of the tremendous rainfall and the great heat, all rocks are decomposed to a very great depth, the product of the weathering being a tenacious white, brown, or yellow clay, which forms the usual bed-rock of the gravel deposits.

The village of Tomo, where the Chinese rajah resides, is a fairly flourishing place, with a population probably of three or four hundred; it lies on the bank of the river in a rather narrow valley, the elevation of the village being about 700 feet above sea-level, whilst the hills on either side rise to a height of about 1200 feet. On ascending the river beyond Tomo, the character of the country becomes wilder and more mountainous, the river breaking up into a number of mountain streams, veritable torrents in the wet season. Mountain chains are seen to succeed each other to the south, forming the great watershed, apparently, between the Telubin, Patani, and the other rivers that run northwards, and the great affluents of the Pahang river (?) that trend southwards.

The deposits of gold cease close above the village of Pacho, and the mountains beyond this point appear to consist almost entirely of granite.

It can only be said that nothing whatever is known of the geography of this mountain chain—not even the Malays themselves having ever traversed it, as far as I could learn. I have probably penetrated as far into it as any one, but could see no inducement to extend my researches in that direction. I spent a considerable time in exploring the valley of the upper Telubin, or the Tomo valley, as it may fairly be called, and extended my journeys to the Kelantan and Patani valleys, on the east and west respectively. By this time (the beginning of October) the rainy season had set in, and the upper river, which was not navigable for boats, had become a torrent. It was, however, absolutely necessary to descend it, and it therefore became necessary to construct bamboo rafts, and to commence our journey down river on these until we got to a point where we were able to obtain boats—a journey that proved to be attended with considerable hardships, and to be by no means free from actual danger, although accomplished without loss of life.

Although canoes can ascend the river as far as Chukai in the good season, yet a miserable village called Bene, in the neighbourhood of which there were formerly extensive alluvial gold diggings, is generally looked upon by the natives as the limit of navigation by boat of the Telubin. Bene is also the frontier station, on the river, of the Chinese rajah's domains, and has thus, in spite of its present state of squalid destitution, some local importance. Between Bene and Tremangan only small boats—carrying, say, two tons—are able to navigate, but from the latter point to the mouth of the river, large river-boats carrying over five tons are employed. These large boats are admirably constructed crafts.

The keel portion is formed of a flat-bottomed dugout, the sides being built up with hewn plank to the height of about 2 feet. The central portion is further built up into a kind of house about 4 feet high, and at times 15 feet long, the width of a large boat of this kind being about 6 feet. The bow and stern portions are decked over, the deck overhanging the sides of the boat considerably, so as to form a broad platform. It must be remembered that this entire structure is put together without the use of a particle of iron, being secured with wooden pegs and bamboo lashings, and made watertight by means of a curious resin known as "damar," which is found plentifully in the decayed trunks of certain species of trees. On the stern end of the platform stands the steersman, who uses a broad and heavy oar lashed to the boat as a rudder; on the bow platform are usually six men with long poles, who punt the boat up, three on either side. The punting is done by the boatman setting the butt of the pole (which is furnished with a small block of soft wood) in the hollow of his armpit, whilst he walks along his platform from the bow towards the stern of the boat, but, of course, only as far as the deck-house, which extends, as already said, right across the boat. Thus on each side two out of the three boatmen have always their poles in the water, pushing the boat, whilst the third man is going back to his place at the bow to take his turn, the men constantly following each other in rotation. It is extremely hard work, but the men keep at it for hours together, only stopping now and then for a chew of betel. When going downstream, poling is not necessary; the crew usually consisting of one or two men paddling, and one steering. The main difficulty then lies in shooting the rapids, with which this river abounds, there being some forty-five important rapids, besides numerous minor ones. When the boat comes to a rapid it is tied up and unloaded, all the cargo being carried by the men to some convenient spot at the foot of the falls. Two of the best men then take their places at the bow with poles, whilst the steersman sees carefully to the lashings of his steering-oar, and the rest of the crew grasp their paddles. With wild yells the boat is then pushed into the midst of the foaming torrent, which carries it over the rapids at a flying speed, the safety of the boat being due entirely to the thorough knowledge by the boatmen of the exact position of each hidden rock, and to the skill and activity which they display in handling their apparently unwieldy craft, which they do so dexterously that accidents are extremely rare. Nearly all the more important rapids have superstitions and legends connected with them, the Malays, and even the Chinese as well, being in the habit of offering some kind of trivial sacrifice at some conspicuous rock near the rapid, which is supposed to be the residence of the spirit who presides over the rapid in question, and who has to be propitiated to avert accidents. In going upstream the boats have to be hauled up the rapids by means of ropes made of rattan, of course

after being unloaded. This type of river-boat is common to all parts of the Malay peninsula, but there are characteristic differences in detail of construction that distinguish the boats of the northern watershed from those of the Pahang side.

Besides the alluvial gold at Bene, there is an interesting occurrence of gold quartz, in a series of small reefs in slates and schists close to this spot, in a small stream known as the Katia. A party of Chinese worked this place, and excavated a large hole in following down the reef until they were drowned out by a sudden flood of the stream. It was at this spot that I came across the only example I have ever seen of the use of the fire syringe for domestic purposes by the Malays, as has been recorded by my friend, Mr. F. W. Rudler (*Science*, August 4, 1893, p. 65), in whose possession the instrument now is. There is gravel worked further down the Telubin for a few miles more, when it all ceases, at an elevation of about 300 feet above sea-level. The country becomes less hilly, and the geology changes somewhat abruptly. No more shales are to be seen, but only occasional bars of granite, whilst the river banks are more sandy, and in places consist of laterite ; finally, about Tremangan the hills cease altogether, and the remainder of the course of the Telubin to its mouth is through flat sandy plains, which are in all probability due to the action of the river itself. It must be remembered that the banks of the river are everywhere clothed with dense impenetrable jungle, except in the few isolated spots where a little clearing and a few bananas and cocoanut palms indicate the existence of villages, which are all small and unimportant.

I made a journey from Bene to the headwaters of the Benara, or Tanjong Mas river. It is curious to note that the watershed between what are really two important rivers is formed by a very trifling flat ridge, not 100 feet in height at the place where I crossed it, and consisting largely of swampy ground.

The headwaters of the Tanjong Mas have, like those of the Telubin, been worked extensively for gold by the Chinese; but the Malays were so persistent in their murderous raids here, that at last they killed or drove off all the Chinese, and the extensive mines commenced by these latter have lain deserted ever since. These gold workings are remarkable for the fact that some of them consist of auriferous laterite, which is in places comparatively rich, but mostly only very poor. Still the occurrence is unusual enough to be worth recording.

A similar expedition from Tomo to the headwaters of the Kelantan river, to a point known as Blimbing, showed that the real watershed separating the Telubin and the Kelantan rivers is here also very low indeed, tributaries of these two important rivers rising within a few yards of each other from either side of a very low ridge. It is remarkable that in the entire length of the Telubin river there is not to be found a single indication of limestone, whereas the upper portions of the

valleys of the rivers on the east and west respectively, the Kelantan and the Patani, show enormous cliffs of highly metamorphosed white and grey limestones. There is one, for instance, close to Blimbing quite 400 feet high, and I shall have occasion to mention far more important developments of this formation when speaking of the Patani. Here I need only say that these limestones appear to be quite unconformable to the underlying rocks, and that they seem to be the result of extreme metamorphism of coral reefs; this hypothesis, however, needs confirmation by a microscopic examination of the limestone itself.

The most important of the little villages on the lower Telubin is Kekabo, which derives such importance as it possesses from the fact that it is the river port on the east, of Khota Bharu, the capital of the powerful state of Reman, with which it is connected by the usual jungle road, at about three hours' distance. Reman is a state that has an extensive river frontage on both the Telubin and the Patani rivers, and, besides this, extends far into the mountainous portion of the interior. The rajah, an oldish man and a noted shot and sportsman, appears to possess great power. It would seem that he looks upon the inland position of his dominions as rendering him comparatively difficult of molestation by the Siamese, and their rule weighs very lightly upon him. He nevertheless pays triennial tribute to the extent of one gold and one silver tree, each weighing 25 taels (say 32 ozs.), and together estimated at $3000 in value. In addition to this, he pays some 50 or 60 taels (65 to 78 ozs.) of gold, elephants, cattle, etc., making the total amount of his tribute up to something like $12,000. To meet this, a poll tax varying from $1 to $3, according to the means and position of the individual, is imposed on each man, and smaller amounts on each woman and child. A rough census taken for the Chakun of Singgora some little time before my arrival, showed that the state of Reman contained some 5000 able-bodied men. The rajah is absolute ruler and owner of the whole state, and is apparently liked and respected by his subjects. Khota Bharu is the official capital of his state, but he passes much of his time at Goa Kapor, a small place on the Patani. Khota Bharu is a small village lying in an extensive flat plain, except on the south side, where it abuts on some low jungle-covered hills; for some miles round the town all the jungle has been cleared off the plains, and the ground is devoted to the cultivation of padi. The town really consists of a scattered group of small villages, each containing from three to a dozen houses, scattered amongst the padi fields within a radius of a mile or so round the royal palace, if a group of irregular, roughly built, but large bamboo huts surrounded by a high fence of bamboo deserve so pretentious a title.

Not very far from this capital, there are important tin-mines, whence cassiterite in a state of great purity in large pale-coloured crystals is obtained, occurring apparently in seams in decomposed granite. Khota

Bharu is about equidistant from the Telubin and the Patani rivers, the port on the latter being known as Biserat, which is, however, in the territory of the neighbouring state of Jala. Accordingly, almost the whole of the traffic from Khota Bharu is carried on *viâ* Kekabo. Here again it may be noted that there is no well-defined watershed separating these important rivers. Biserat, though neglected by the Reman people, is yet an important place for two reasons: firstly, there is a notable Siamese temple, or watt, about a couple of miles from it; and, secondly, it is the port for the capital of the state of Jala, known as Kampong Raja Jala. The Siamese have quite a settlement at the above-mentioned watt, there being a number of priests' houses grouped about a large cave in a precipitous limestone escarpment. The general features of the country here consist of a series of plateaux, surrounded and separated from each other by precipitous cliffs and perpendicular hills of limestone. The cave in question is in the sides of one of these, and the view from it, beautiful anywhere, is one of quite exceptional beauty for a jungle country, powerfully aided as it is by the gleam of a small sheet of water at the base of the hill; whilst the plateau itself is clothed in the tender green of the growing padi, with fringes here and there of cocoanut and areca palms, clumps of which surround each house or little village, whilst dotted amongst the fields there are great clusters of feathery bamboo. In marked contrast to these light shades is the frame of surrounding low hills, covered with their dark green tangle of heavy jungle, above which the dark crests of still higher ranges appear, whilst the gleaming white of the limestone escarpment shows out boldly here and there amongst the dark masses of jungle. After months of travel in a jungle country where extensive views are quite exceptional, one of such beauty cannot fail to leave an indelible impression on the memory.

The cave itself is not over 100 feet by 50 broad. Along one side of it is a reclining figure (? a Buddha, or a Siamese king, or high priest), built of bricks and plaster, some 50 feet long by 15 feet high, surrounded by a number of other seated figures, eighteen in all. It is to this cave that the surrounding rajahs have to come, or send their representatives, in order to drink the water of allegiance (an act equal to taking an oath of fealty) to the King of Siam every half-year, and this Siamese colony is thus not only an important outpost of Buddhism, but is evidently considered of importance from a political point of view. It need hardly be said that these Malays are strict Mahomedans.

From Biserat to the capital of Jala is only about a three hours' journey along a rough jungle track. The capital lies on the western edge of one of the before-described plateaux, surrounded by steep limestone cliffs. There is nothing distinctive about it or about the residence of the rajah, who is an old man of apparently very limited intelligence and not much authority. He seems to play a comparatively subordinate part, leaving most of the administration of the affairs of his state to his

ministers; in so far, he may be said to be rather more of a constitutional ruler than is customary among the Malays. His state is very sparsely populated, the number of men being estimated as little more than one thousand. There may be said to be no interior to this state, the whole active life of which is confined to the river Patani. I followed a native track through the jungle for two days without coming to a single habitation. The river Patani, on the other hand, is fairly well populated. This river may be spoken of as well known, it having been ascended and descended very often by Europeans whilst the galena-mines near Goa Tumbus were being worked. I do not accordingly think it necessary to say much about it, more especially as in its whole course it presents nothing on either side but a series of low sand banks, covered with dense jungle, relieved by an occasional village, whilst higher up near its source it winds its way past numerous steep and picturesque limestone escarpments.

The geology of this river is utterly different to that of the Telubin. There are neither shales here nor granitic outcrops; only sand and limestone, the latter being, as already mentioned, conspicuously absent from the valley of the Telubin. Near its mouth the Patani splits into several branches, forming a comparatively large delta, most of which is devoted to the cultivation of padi. The capital of the small state of Patani—all that is now left to the rajah of what was formerly the most powerful state in this part of the Malay peninsula—lies on the main channel. It is a very thriving, busy town, there being here a flourishing colony of Chinese, some Siamese, and a few Arabs, who carry on a fair amount of trade with the interior by means of the river, and with Bangkok, Singgora, Tringganu, and Singapore by sea, the chief articles of export being salt, rice, tin, fish, pigs, and fowls. The town contains probably 2000 inhabitants; those of the whole state being said to number 5000.

Going up river and passing Biserat, the next place of importance is Benang Sta, which forms the port of the tin and galena mines. The galena, which, as before said, was worked by an English company, occurs in small pockets either in the limestone or more often at the junction of the limestone and granite. It was not rich enough in silver to be worked profitably, the company failed, and the mines are now utterly deserted. In the immediate neighbourhood of the galena deposits there is, however, a large colony of Chinamen, who work alluvial tin. There is one deposit here, quite unique, as far as I know, in the world. It has been produced by the gradual degradation of cassiterite-bearing granite and of limestone containing pockets of galena, the result being a gravel cemented by oxide of iron, the product of the decomposition of large deposits of iron and arsenical pyrites. The Chinese sluice away the worthless earth that overlies this gravel, and break the latter out with heavy crowbars. They then stamp it under tilt hammers worked

by the foot, made entirely of wood, with a stone head and a stone for a mortar. The crushed gravel is washed, and, as the result, there is left a mixture of tin stone with oxidized lead ores, principally anglesite, cerusite, pyromorphite, and mimetite, all decomposition products of the original galena deposit. The Chinese smelt this residue with charcoal in small blast furnaces about 7 feet high, producing, besides a good deal of lead fume, a natural alloy of lead and tin. In fact, this curious mine may be correctly described as a "pewter mine." The alloy of lead and tin so produced is sold by the Chinese to the rajahs of the surrounding states, who use it to make the small coins, the "pitis," already referred to. I analyzed one of these pitis, and found it to contain—

Lead	69·4
Tin	27·9
Iron	0·7
Sulphur, arsenic, and other impurities	2·0
	100·0

and this may be taken as the typical composition of the natural pewter here smelted out.

Another curiosity from the mining point of view is a small underground stream which runs beneath a huge cliff of limestone for about half a mile, practically the whole length of which has been worked for alluvial tin. In addition to these lead-tin mines, there are numerous others among the hills where alluvial tinstone of a very high degree of purity is obtained and smelted by the Chinese in small furnaces. All this tin is sent down the Patani river to the town of Patani, whence the bulk of it is exported to Singapore, so that this tin district, which provides profitable employment for several hundred Chinese, is the main source of the wealth of three states, Reman, Jala, and Patani. The output is probably from 200 to 400 slabs of tin of 60 kati each per month; say altogether 140 to 280 cwt., including both the lead and the pure tin, the former being worth only about half as much as the latter.

After a thorough exploration of the Goa Tumbus district, which extended to the head waters of the river Tiba on the frontier of Keda, the results of which are recorded on the accompanying map, I returned down the Patani to Biserat. It may be truly said that all these Malay States present so many points of similarity, whilst salient points of interest are so few and far between, that a detailed account of my many months of jungle travel through them would only be wearisome to the reader, and could serve no useful purpose that cannot be better performed by the map of my route.

At Biserat I left the Patani, and, crossing Reman again to Kekabo, I continued my journey down the Telubin to Selindong Bayu at its mouth, this portion of the journey presenting no feature of any special interest. Arrived at Selindong Bayu, we found that the north-east

monsoon was blowing. There being, however, no alternative, as my funds and provisions were exhausted, I chartered a small but stoutly built Chinese boat with a crew of four Chinese, and induced them to put to sea, and after five days with some difficulty made the mouth of the river Tringganu, where we fortunately found a small trading steamer bound for Singapore, which took my party and myself back in safety, arriving there on March 17, 1891, after an expedition that had lasted exactly seven months.

I may add a few words as to the method employed in mapping my route, as it may prove useful to explorers under similar circumstances. I made a careful time and compass survey of the rivers as I went down them, taking bearings on to all prominent points that could be seen from the boat. Whenever possible, I took the sun at midday by means of a good sextant and an artificial horizon; I thus obtained my latitude, at any rate, every other day. It will be noticed that the general course of the rivers is northwards. I accordingly resolved all the traverses obtained by the time and compass survey, adopting some convenient arbitrary rate of travel. I thus obtained a supposed difference of latitude for each day's work, which, corrected by the observed differences as obtained by my meridian observations, gave me the elements for correcting the co-ordinates of each traverse by multiplying or dividing by the constant thus found for each day's work. The method is not a difficult one, is fairly rapid, and extremely accurate if carefully worked.

A SURVEY OF THE ENGLISH LAKES.

By HUGH ROBERT MILL, D.Sc.

THE following brief abstract contains an outline of the report on the survey of the larger English lakes, which was presented at the meeting of the Royal Geographical Society on June 18, 1894. The full discussion will be published by the Society in a separate form, with maps on the scale of 2 inches to 1 mile (1 : 31,680) and numerous other illustrations. Notes of the progress of the work have appeared from time to time in the *Journal* (see vol. ii. pp. 165, 362, and 548; and vol. iii. p. 421).

The Lake District of North-western England is a remarkably definite and symmetrical geographical unit. It may be roughly described as a circular mass of elevated land, highest in the centre, and furrowed by a series of valleys running from the centre toward the circumference like the spokes of a wheel. Most of these valleys contain long narrow lakes of considerable size, and of a different type from the small round mountain tarns which also occur in the district. A circle of 15 miles' radius drawn from the centre includes all the lakes and all but one of the tarns.

Numerous soundings have been made in most of the lakes by members of the geological survey and others; but until the author of the paper, with Mr. Heawood and other assistants, undertook the systematic survey of the depths last year, at the expense of the Royal Geographical Society, there had been no attempt to construct definite maps of the basins, comparable in accuracy with the Ordnance Survey's contouring of the exposed surface of the land. In all other countries, limnology, the science of lakes, has been pursued with much diligence, and in several, particularly in France and in Switzerland, the work has been carried out by Government.

A lake must be looked on as the product of a long process of evolution which still continues. The formation of the primitive hollows is so remote in time, that modifications by deposit of sediment and wearing away of the banks have now almost, if not entirely, obliterated the evidence of the agents which produced them. Thus the lake district contains scenery of different chronological orders.

The methods employed for ascertaining the depth and fixing the position of each sounding, and for mapping the resulting information are fully detailed in the complete paper. A special feature was that the work of each day was plotted on the 6-inch map the same evening, so that any uncertainties might be detected and investigated before leaving the neighbourhood of the lake. The lakes considered were Windermere, Ullswater, Coniston, Wastwater, Ennerdale Water, Buttermere and Crummock Water, Derwentwater and Bassenthwaite Lake, and Haweswater, each of which was found to have certain special characteristics which distinguished it from all the others.

The more important statistics regarding them are condensed in the accompanying table:—

TABLE OF STATISTICS OF ENGLISH LAKES.

Name.	Length, miles.	Breadth, yards.		Elevation of surface above sea, feet.	Depth, feet.			Area, square miles.	Volume, million cubic feet.
		Max.	Mean.		Max.	Mean.	Mean per cent. of max.		
Windermere....	10·50	1610	950	130*	219	78½	36	5·69	12,250
Ullswater.....	7·35	1100	827	476	205	83	40	3·44	7870
Wastwater	3·00	880	650	200*	258	134½	52	1·12	4128
Coniston Water.	5·41	870	600	143*	184	79	43	1·89	4000
Crummock Water	2·50	1000	700	321	144	87½	61	0·97	2343
Ennerdale Water	2·40	1000	800	369	148	62	42	1·12	1978
Bassenthwaite Water.....	3·83	1300	950	223*	70	18	26	2·06	1023
Derwentwater ..	2·87	2130	1270	235*	72	18	25	2·06	1010
Haweswater....	2·33	600	405	694	103	39½	38	0·54	589
Buttermere	1·26	670	620	331	94	54½	58	0·36	537

* Depths determined at time of sounding, other depths + 2 feet.

There are two main types amongst these lakes, the shallow and the deep. The former includes only Derwentwater and Bassenthwaite, the broadest of all the lakes; they only average 18 feet in depth, and their average depth is only 25 per cent. of their maximum depth, a smaller ratio than for any other lakes. The bed of these lakes may be roughly described as an undulating plain, grooved and ridged into shallow hollows, and low shoals running parallel to the long axis of the lake. The fact that these lakes are separated by a strip of alluvial ground so low that their waters mingle in heavy floods, shows that they may in some ways be viewed as a single lake, and the configuration suggests that they may have been shallowed by glacial accumulations.

The second, or deep type, the shallowest of which has an average depth of 40 feet, and in which the average depth varies from 36 to 61 per cent. of the maximum depth, showing a steep-sided character, comprises all the other lakes. Ennerdale, however, combines the characteristics of the two, conforming to the deep type in its upper, to the shallow in its lower reach. The deep lakes are long, narrow, sometimes winding like Ullswater, or slightly curved in outline like Wastwater and Haweswater. The most characteristic lie in long narrow valleys with steeply sloping sides, and the slopes are continued under water with almost equal steepness, in some cases with greater steepness, and terminate in a nearly flat floor. The typical form of this class of lake is thus a steep-sided flat-bottomed trough, diversified along the slopes by the still steeper conical mounds of *débris* thrown down at the mouths of streams.

In Haweswater the largest example of a delta occurs, nearly cutting the lake in two; while Buttermere and Crummock, lying in one uniform valley, are entirely separated, probably by the same action, and the separation of Bassenthwaite from Derwentwater is probably of similar origin.

Although most of the lakes show only one clearly defined trough, the two largest are divided into distinct basins. In Windermere, the shoal on which Belleisle and the other islands off Bowness rise, separates the deep and wide upper basin from the less deep and much narrower lower basin. In Ullswater each of the three reaches of the lake contains a definite basin separated from the others by broad or narrow bars. From one of these the island of Householm rises, a mass of strongly glaciated rock; but while the position of the basin to the south of it seems to confirm the glacial theory of the excavation of the hollow, the basin to the north of the island is so situated as to make its origin by glaciation somewhat difficult to account for.

Three of the lakes have depths which descend below sea-level. In Wastwater 217 acres lie beneath sea-level, so that if drained to that extent it would present the appearance of a lake still 58 feet in depth

at one point. Windermere, if similarly drained, would show a northern lake 3¼ miles long with a maximum depth of 90 feet, and 3 miles further south a narrower lake 1 mile in length and only 14 feet deep at its deepest, while south of this there would be a still shallower lagoon half a mile long. In Coniston reduced to sea-level there would probably appear one narrow lake 2½ miles long and 42 feet in maximum depth. All the other lakes are situated at such elevations that they do not approach sea-level in their greatest depths.

Summarizing the special features of each lake, Windermere is the longest and has the greatest volume of water; Derwentwater is the widest and the shallowest; Bassenthwaite has the largest drainage area; Wastwater is the deepest both in maximum and average; Coniston is the narrowest of the larger lakes; Crummock the steepest-sided and the flattest-floored; Ullswater the most complex in outline and in structure; Ennerdale unites the deep and shallow types of structure; and Haweswater is unique in the size of its lateral delta.

Altogether, the lakes which have been sounded and mapped cover an area of 20 square miles of unexplored territory. Contoured maps of the ten lake-basins under consideration have been supplied to the Ordnance Survey for incorporation on the official maps of the country.

The paper when read was illustrated by a series of special photographs of the Lake District, and numerous maps and diagrams projected by the lantern. A series of historical maps of the Lake District, lent by Mr. J. E. Marr, F.R.S., was exhibited in the ante-room.

Before the reading of the paper, the PRESIDENT said: We are met this evening to hear the address of Dr. Mill with reference to his report on the survey of the English lakes, which was undertaken under the auspices of this Society. I am one of those who have had the privilege of hearing Dr. Mill before, and I think I can promise the meeting a most interesting and agreeable evening.

After the reading of the paper, the following discussion took place:—

Professor BONNEY: As I have not the honour of being a fellow of the R.G.S., perhaps I may venture to commence by expressing my sense both of the extreme value of these investigations of Dr. Mill, also of the singular facility of diction and clearness of narration, with which they have been put before the meeting. I think, also, the Geographical Society itself is to be congratulated upon the accomplishment of such an extremely valuable piece of work. We now know something of the contours of the lake-beds in the Cumberland, Westmoreland, and Lancashire districts. We cannot but feel a certain regret that it should be left for a society composed of private individuals to undertake such a business. It does seem to me that this kind of investigation is one that ought to have been discharged by the ordnance survey; it has not been for want of application, it has not been for want of urgency, but apparently they have not had the power given them by Government to undertake any research, the result of which is not visible to the eye. I confess that that is only one other indication of how little the ruling powers in this

country care for science; it is fashionable at the present day to praise it, but we may say, perhaps, of science as the old Latin said of virtue, "Probitas laudatur et alget," "Honesty is praised, but left to starve." However, we will not go into these political or semi-political questions. I feel some little difficulty in commenting upon this paper of Dr. Mill's, because I am somewhat in the position occupied, I know not how many years ago, by the oriental prophet, who, when he was sent for to curse, stayed to bless. I do not know how it was, but I had the impression that Dr. Mill had come to conclusions which were antagonistic to those I formed myself a good many years ago, but I find that, instead of having to stand up for my own views, his researches, although he carefully avoided entering upon the controversial aspect of them, are not antagonistic. Accordingly I feel somewhat in the position of a person who has not got very much to say, but I would venture to call your attention to one or two very interesting points in his remarks. We find that in the same district you have the broad and shallow type of lake, and the narrow and deep type, as it were side by side. Now, this occurs where the rocks are not on the whole very different, and yet we are told, in certain arguments brought forward for the glacial origin of lake-basins, that you have the lake broad and shallow in one type of rock, and narrow and deep in another. Again, when you go into the adjoining room and examine these maps where you have the work of M. Delebecque in the French lakes, and the work of Professor Forel in some of the adjacent Swiss lakes, you will see the same types of structure in the forms of their beds that you have seen on the screen to-night; it is a remarkable fact that in so many cases you have these flat plains in the beds of lakes, on the existence of which Dr. Mill insisted more than once this evening. Now, such a type of lake would be appropriate if the lake has been excavated by glacial action. Nevertheless, we find the contours from above the surface of the lake are carried down underneath the surface, as you have seen more than once in the photographs, also in some of the maps in the next room. Lake Bourget and the Lake of Geneva in Switzerland, the Lake Annecy in France, have these basins, yet we find ourselves, supposing we assume a theory of glacial excavation, pulled up again and again by the existence of anomalies in structure hard to explain upon that theory. There is, in addition, a further and wider difficulty. Whenever we know the shape of the valleys above the lake-basins, we find they indicate that glaciers have not any great excavatory power. It would take far too long to discuss this subject, so I will merely say it appears to me there is a peculiar value in these particular investigations. I have never denied that under certain circumstances a glacier may excavate; of this we have probably some trace in corrie-tarns. These circumstances are when the level of the glacier changes suddenly, or when it has to struggle over some intervening obstacle, as in a narrowing valley; but we see in most cases that in a valley occupied by glaciers you have to draw a distinction between this and water erosion. Now, it appeared to me, after the investigations of my friend Clifton Ward, that these lakes in Cumberland and Westmoreland, and some of the smaller lakes in Scotland, were upon the borderland—possibly produced by the excavation of ice, possibly also by other causes, probably differential movements of the Earth's crust. I think that these careful and precise investigations, giving us facts upon which we can argue, will enable us to fix more precisely the limits between the small basins probably due to the excavatory action of ice, and those other and generally large basins produced by differential action of the Earth's crust, and the consequent flooding of beds of valleys already worked out by the ordinary processes of river and subaerial denudation.

Mr. J. E. Marr: I rise with a considerable degree of diffidence, because, in the first place, I have not the honour to belong to this Society, and also I find that I am

about to follow my old college tutor. With regard to the admirable paper we have heard to-night, I may remark, in the first place, that Dr. Mill was good enough to send me for examination the soundings he obtained. These I submitted to two experts, Mr. Hutchings, and Mr. Woods of Cambridge, who examined them for minerals and organisms. One point comes out concerning the examination made by Mr. Hutchings which, I think, will interest the Geographical Society and Dr. Bonney. He found the soundings of Bassenthwaite entirely different to those of the other lakes, as would be expected. But Coniston is situated in rocks similar to Bassenthwaite, yet the soundings of these lakes are like those of others; so he concluded that the Coniston streams must drain chiefly through volcanic rocks. Is it possible that we can prophesy concerning the hydrography of regions by a microscopic examination of their sediments? I have had the pleasure of seeing Dr. Mill's maps before this meeting, and there were certainly one or two points that struck me as particularly interesting on account of their bearing upon the origin of the lake-basins. I will touch upon one or two points. As regards Ennerdale, the deepest part of this lake lies in the granite rocks, the shallowest part in the soft sedimentary rocks; it seems remarkable that ice should have excavated more extensively the harder rocks than the soft sedimentary rocks. Then there is Loweswater, exceptional in all our lakes because it drains towards, and not away from, the centre of that district, which necessitates that the ice should be working uphill—by no means impossible, but in this case difficult to imagine. Then I saw in the map of Windermere one feature which will probably be brought out very often on further study of Dr. Mill's maps, a feature remarkably like a submerged river-valley. The contours above the lake here are closely parallel with those below the lake. On any glacial erosion theory, this depression (which is in Pullwyke Bay) would be produced by ice coming from the west. Now, those who know the district know there is no opportunity for the formation of such a glacier. As a matter of fact, the ice went absolutely at right angles; so it seems the submerged valley is one formed previously to the formation of the lake, which is dead opposed to any theory of glacial action for the formation of these lakes. Valuable as Mr. Ward's work was, he could not, in the time at his disposal, carry out the survey in the admirable way in which it has been carried out by Dr. Mill. I am expressing the opinion of all geologists when I say we shall heartily welcome this work, which is the starting-point for fresh controversy on this subject. We shall have the origin of lake-basins again discussed at an adjoining society, and it will be decided by the data supplied by the author of to-night's paper.

Captain WHARTON: I suppose the President has called upon me to make some remarks because I have had a great deal to do with sounding, otherwise I must say I do not see the connection between my work and the sounding of lakes. I am very glad of this opportunity of expressing my recognition of the great value of Dr. Mill's work, and congratulating him that there should have fallen to him to do what has been so very long neglected in this country. The fact is that the lakes have fallen between two stools—the ordnance surveyors have been prevented from doing it, and the hydrographic department has been unable to see that the lakes and tarns come distinctly under the head of navigable waters. It is true that one of my predecessors strayed from the paths of virtue and sent some sailors to sound Loch Lomond, but since that time we have been obliged to confine ourselves to our own waters, the sea. One point of Dr. Mill's interested me—the slopes of the lakes, especially those where there are screes, and it shows that the shallow slopes we get off cliffy shores are due to the action of the waves, as you do not get them in lakes. I do not see myself that it has anything to do with the formation of the lake, because, as I take it, those contours are not those of the original rock, but of the tumbled fragments

broken up by subaerial denudation. I was interested also in the description of Dr. Mill's sounding operations, and am very glad to see that he has by his own force of intelligence arrived at the same conclusion we arrived at some time ago—that you must plot your work on the ground and examine it before you go away, or you may leave out a most important part. I am sorry to say the earlier surveyors very often, in the press of work, took their soundings and did not actually make their charts as they went, and consequently many suspicious places were left unexamined. I do not know that I can do more than again heartily congratulate Dr. Mill.

Mr. E. Heawood: There is little for me to add to Dr. Mill's admirable description of the English lakes. One point, however, on which I should like to touch very briefly is the position of the deepest basins relatively to the general form of the valleys in which the lakes occur. In the case of lakes dammed back, whether by landslips or glacial deposits, we should expect to find a gradual deepening from above downwards in accord with the slope of the valley. Now, in their present condition, at any rate, this is not the case at all with the English lakes. Considering Derwentwater and Bassenthwaite as properly forming a single basin, and the same with Buttermere and Crummock, I find that in four of the principal lakes the greatest depression occurs in the upper half, in three it is central or but slightly below the centre, and in one case only, that of Buttermere and Crummock, does it occur decidedly towards the lower end, but even here an important depression is found quite at the upper end. If we search for some definite rule which governs the position of the deep basins, there seems ground for the assertion that they occur in association with the highest parts of the shores, or, as I should rather put it, with the points where the high ground slopes most steeply to the water. To give only one or two instances: abreast of the deepest part of Derwentwater the 1000-foot contours on the two shores are only $1\frac{3}{8}$ mile apart; they afterwards widen out to over 3 miles, but again close in to the former distance just where the deepest part of Bassenthwaite occurs. In Buttermere and Crummock, the deepest parts respectively are just between Robinson and High Crag, and between Grasmoor and Mellbreak; and in Wastwater between the highest point of the Screes and Middle Fell, where the 1000-feet contours are only $1\frac{1}{4}$ mile apart, while at the lower, shallower end they have widened to nearly 2 miles. The reason would seem to be, not that the materials from beneath the depressions have gone to make the mountains, but that opposite the steep slopes the lakes have not been filled up by the wear and tear of the mountain sides to anything like the same extent that they have elsewhere. The fact that the shores recede, of course means that the lake receives the drainage of a larger area of country, the products of the denudation of which eventually find their way to it, and, in accord with the above-mentioned position of the deep basins, we find that hardly any important streams empty themselves into them. As to the question how far the shallowing can be due to sedimentation, although, from the very steep angles at which the deltaic material slopes into the water, it might appear that the effect cannot reach far from the shore, we must consider that this material is simply shingle which is pushed out into the water, and that the fine matter held in suspension behaves very differently. It seems natural to suppose that even when once deposited it is not finally at rest, but that, under the combined influence of currents and gravitation, a gradual movement out into the deepest parts would take place. Gravity then ceasing to act, there would be no tendency to further shifting. If the above explanation is correct, the shallowing at the lower ends of the lakes would be a natural corollary of their radiate arrangement, which, to some extent, involves a progressive widening of the drainage areas from the centre outwards. The idea also that the original form of the valleys is best preserved in the deep basins, is borne out by the fact that it is

just here that the correspondence of the slopes above and below the water is most marked.

The fact that the lakes as a whole reach just as far and no further than the beginning of the more level country which skirts the district, is in one way merely an extension of the principle of the shallowing at their lower ends. The same fact also shows that they are not held back by anything like a dam thrown across a narrow valley, for in some cases we should have to traverse the level country for miles before reaching a point as low as the deepest parts of the lakes, in several cases considerably below sea-level.

Mr. Douglas Freshfield: In this Society we are generous in our obituary, or, as I may surely say, quasi-obituary notices of departed officers. I feel, after the reference made to myself in the President's annual address, that there may appear to be something unseemly, almost improper, in my posthumous appearance here to-night. But since Mr. Markham was good enough to express a hope that I should continue to take "a warm interest" in your affairs, and still more since, if I come before you as a "hollow ghost," it is in order to praise a "living man," I hope you will forgive my intrusion on this discussion. The rare occasion of a paper being read before the Society by one of our permanent staff appears to me a fitting opportunity for paying a debt due to that body from your honorary officials. And there are few—there is, I believe, no one—who can speak with more experience than I can of the services our heads of departments have rendered in the last fifteen years, and are rendering to the Society. It would be invidious to draw distinctions where all are alike in devoting not only their office hours, but also much of their leisure, to promoting the interests of the Society, and spreading the science it ought to represent throughout the country. The excellent paper laid before us to-night is only one among the many fruits of this fortunate zeal in our officials.

The subject of Dr. Mill's researches has long attracted the attention of serious students of mountain structure. Since the days of De Saussure physical inquirers have asked to know the conformation of the concavities as well as of the convexities of the Earth's surface. The founder of modern geology, in the map which forms part of his work, gave the depths of the Lake of Geneva as well as the heights of the crests that encircle it. The greatest depth he measured was roughly 1000 feet, and it is, I doubt not, on this measurement that Byron founded his circumstantial statement—

> "A thousand feet in depth below
> Its massy waters meet and flow,
> Thus much the fathom-line was sent,
> From Chillon's snow-white battlement."

This passage probably misled the unwary until in 1837 our old friend, the late Mr. John Murray, in the first edition of his 'Swiss Handbook,' which he wrote in great part himself, cut down his own poet's round figures to a bare 280 feet. This measurement of the depth below the walls of Chillon has lately been confirmed by the Federal Survey. Those who are acquainted with foreign cartography know that in Switzerland the Government maps—to speak precisely, the Siegfried Karte—show the lake-depths by contour-lines laid down with the detail and nicety which distinguish the work of that most intelligent, efficient, and enterprising department. The Swiss Survey Department is a model to all nations of what such a bureau should be, producing the best possible work, placing that work before the public in the most convenient forms, and ever ready to assist scientific or general publications by the loan of any material in its possession. It has thus created a national standard of cartography which is

generally recognized by competent critics as above that of any country in the world. In France the mapping of lake-basins has been undertaken by the Department of Public Works, but elsewhere on the continent—in Bavaria, for example—it has, I believe, been left to private enterprise. In our own country science has for some time endeavoured to interest the two Government departments who might, by unofficial and inexperienced minds, be supposed to be concerned in the matter. The Survey Office was sympathetic, apologetic, but in the main evasive. It quite agreed that lake-depths form part of a complete survey, but it represented that no special instructions had been given, or funds allocated to it for this purpose, that it had no boats or persons trained to use them, and that it would be well, perhaps, to apply to the Admiralty. The representative of that department, however, roundly repudiated any concern with waters not navigable. He was most decidedly "of opinion that the matter had nothing whatever to do with the Admiralty." If it had surveyed Loch Lomond—that was "long ago"!* The result of our inquiries was that the officers of the Society recognized that if we wanted the thing done in our lifetimes, we must at any rate make a beginning ourselves. In Dr. Mill we felt we had the right man at hand. He had already earned a medal from his countrymen at Edinburgh for his researches in Salinity, for his feats on salt-water fjords. He has again shown his competence in the valuable collection of fresh-water facts he has laid before us to-night. My own views on lake-basins have been set out somewhat fully in our *Proceedings*, vol. x. N.S. I shall not attempt to-night to draw inferences from Dr. Mill's facts in favour of any theory. I would rather endorse his cautions, that we should not attempt to theorize until we have both a full collection of facts and time to consider them, and that we should give due weight to the alterations in the primitive forms of lake-basins caused by the incursion of alluvium and earthfalls. There are many inland waters still to be sounded in British territory. With regard to those in our great colonies and dependency, a step has been taken by a body to which Professor Bonney and I both have the honour to belong, the Committee of the Alpine Club. It has sent a memorandum with regard to possible observations bearing on glacial action, including lake-basins, to the Governments concerned, and from these, Canada, New Zealand, India, it has received very encouraging replies. More than this, the Governments have taken the very practical step of distributing our memorandum among their surveyors. With regard to the inland waters still unsounded and uncontoured in Great Britain, I have also some hope. I commend the matter to the special attention of the President of the Geographical Section of the British Association, which meets at Oxford this summer, and I trust he may be able to bring his weighty personal influence to bear on his other self, the Hydrographer to the Admiralty, so as to induce that official to return to the paths of his predecessor who surveyed Loch Awe and Loch Lomond, and to yield to science her modest demand—that of Three Men in a Boat.

The PRESIDENT: I am afraid at this late hour we must close this interesting discussion. The meeting will agree with me that we have seldom listened to a more admirably spoken address than we have heard this evening from Dr. Mill. It occurred to me that the most characteristic point in it was its suggestiveness. For we were told that there is still an unknown part of England which has been recently surveyed by Dr. Mill for this Society, and which, I believe, covers about 20 square miles of ground. We have also had pointed out to us almost a new branch of our science, namely, limnology, which this Society and the Council of this

* See Report of Departmental Committee on Ordnance Survey, 1893, answers 589-95, and 5012-18.

Society should take every opportunity of fostering. Hitherto we have looked only to the discovery of the surfaces of great lakes. I can quite well remember, when I first became officially connected with this Society, we were full of the discovery of Lake Nyasa, and now I hear, somewhat to my astonishment, that the Admiral at the Cape Station has actually proceeded to this lake, unknown 30 years ago, and hoisted his flag on one of Her Majesty's ships on that lake in order to inspect that portion of his squadron, and I venture to think when this has been done on the surface of the lake it will be considered within the duties of the hydrographer to explore its depths. But we all know that the hydrographer does all he can to further the interests of the department over which he presides, and will only be too glad to extend his usefulness. It now becomes our pleasant duty to return our thanks, not only to the deliverer of this interesting address, but also to others who have assisted him. I consider that the Society and this meeting owe their very grateful thanks to Mrs. Mill for the important part she has taken in this survey and also to Mr. Heawood, and including those two assistants in our vote, I request Dr. Mill to accept our cordial expression of thanks for his most interesting and valuable address.

DR. BAUMANN'S JOURNEY THROUGH EAST AFRICA.*

By E. HEAWOOD.

The handsome volume which has appeared as the result of Dr. Baumann's journey in East Africa, 1891–1893, deserves a foremost place among recent African literature on many grounds. Although in no part passing beyond the limits of German East Africa, the route was so chosen as to traverse a surprising extent of new country in proportion to the total length, such as falls to the lot of few expeditions at the present day; and these unexplored tracts, for the very reasons which have caused them to remain so, are of special interest from various points of view. The scientific training, which Dr. Baumann had already put to good use both in East and West Africa, has enabled him to make the best use of his opportunities for observation, and the result is a work of solid value, not the least merit of which is the comparatively small space taken up with the incidents of the journey, and the amount of attention which can therefore be given to a general survey of the country passed through, in its geographical, ethnological, and economic aspects. The abundant illustrations are well chosen for the elucidation of the characteristic features of the country and its inhabitants, an unusually large number being devoted to the latter.

The general direction of Dr. Baumann's route is well known. Starting from Tanga, the rising port of entry into the northern part of the German Protectorate, and passing to the south of Kilimanjaro,

* 'Durch Massailand zur Nilquelle.' By Dr. Oscar Baumann. Berlin, Dietrich Reimer, 1894.

he struck eastwards into the unvisited tract between that mountain and the Victoria Nyanza, discovering two new lakes, of one of which no report had previously reached Europe. After visiting the south-east shores of the Victoria Nyanza, where he traced the outlines of the gulf bearing his name, he made a tour through the Shashi countries lying east of the lake; and then, to add to his knowledge of the plateau region which he had left, returned by a more southerly route almost to Lake Eyassi. The last section of his outward journey led him to the hitherto untraversed country of Urundi, between the Victoria Nyanza and Tanganyika, containing the source of the Kagera, the principal feeder of the former lake. On the return journey, having reached Tabora by a new route through Uha, he still avoided the beaten track, striking northwards to complete the examination of the East African trough to the south of Lake Manyara. During this extensive journey he was several times compelled to fight to obtain a passage, the opposition of the exclusive Wambugwe near Lake Manyara having this beneficial result, that the cattle taken by way of reprisals afforded the much-needed food-supply for a great part of the journey.

Perhaps the most important section of the route was that through the area of island drainage lying between Kilimanjaro and the Victoria Nyanza. This is a region of elevated steppes and plateaux lying west of the East African schistose ranges, and traversed from north to south by the great East African trough, as well as by two side branches of it—that from which Kilimanjaro rises in the east, and that of the Wembere steppe and Lake Eyassi in the west, which forms a *cul-de-sac* in the plateau. The Masai steppe, almost uninhabited and waterless in the dry season, falls gradually to the central trough in which Lake Manyara is placed. This is a shallow salt lake, with thick deposits of salt on its shores, varying in size according to season, but never quite dry. South of the lake the depression continues more or less marked towards Ugogo. The western wall is by far the steeper, and forms the escarpment of the elevated Masai plateau. While the floor of the trough is of a steppe-like character, the greater precipitation on the plateau supports rich pastures and patches of forest. The air is always cool, and there is less variation between the seasons. The Wembere steppe resembles a salt desert, and the bounding heights are not as a rule inviting. Lake Eyassi shrinks even more than Manyara in the dry season, and its shores are more sandy and devoid of vegetation. The granite plateau of Unyamwesi to the west is marked by great uniformity of surface, mountains being replaced by piles of granite blocks, which are well shown in several of the illustrations. The streams are little more than rain-channels with broad sandy beds, and the dryness seems to be yearly increasing. Still there is water enough for cultivation, tracts of which alternate with uninhabited stretches of steppe-forest.

With regard to the Victoria Nyanza, Baumann, like other travellers, noticed the apparent ebb and flow of the lake, without being able to decide whether it were due to winds alone. After falling for some years, the level is again rising. As regards the feeders of the lake, the author states fully his grounds for claiming to be the discoverer of the "Caput Nili," in the source of the Kagera. There can be no doubt—it was recognized both by Speke and Stanley—that this river is by far the most important feeder of the lake. Its volume is only a third less than that of the outlet, and the water of other streams, with that which falls as rain on the surface, is therefore not much more than enough to counterbalance the evaporation. The contention that the lake itself is the source of the Nile therefore loses its force. But, without wishing to detract from the honour due to the discoverer of the *most remote source* (*i.e.* measured along the stream), we cannot help thinking that the singling out of one among the countless rivulets which supply an equal amount of water, as *the* source of any river, meets the requirements rather of sentiment than science, and, in fact, it is chiefly in the case of rivers whose general origin has been involved in mystery that such an importance has been attached to the definition of the ultimate source. In connection with this subject, it is certainly remarkable that at the source of the Kagera Dr. Baumann should have come across the Missozi ya Mwezi, or "mountains of the moon," * and should have found the country of the Warundi, to be known to the neighbouring tribes as the "land of the moon," from a past ruling race, derived thence by tradition. While careful not to lay too much stress on this coincidence, Baumann thinks that an earlier greater extent of this kingdom may have led to the appellation being connected with the Nile sources. At all events, more is to be said for this theory than for that which connects them with Unyamwezi, which name was originated by the coast traders.

The country between the Victoria Nyanza and Tanganyika is traversed by the Central African schistose ranges which bound the Central African trough to the east. Characteristic of this region is the perennial nature of the streams, the amount of water derived from the hills being very great. The southern versant of the Nile-Congo watershed is, however, dryer than the northern. Lake Akanyaru, which had figured on our maps since Speke's time, has now to be dismissed, though the existence of a lake at the source of the Rusizi, also first mentioned by him, seems to have received confirmation.

The chapters dealing with the ethnology of the regions traversed are of special interest, the author not merely giving a full account of

* It is remarkable, also, that the locality should so closely agree with that in which Speke placed his "mountains of the moon," from which he derived the Kagera. It should be mentioned that the author fully appreciates Speke's merit, and dedicates his book to his memory.

the customs, implements, etc., of each tribe, but dealing in a comprehensive way with their connection with one another, their origin, and so forth. The region is of particular interest as forming the borderland between the Bantu and Hamitic races, while the physical nature of much of the surface—the wide uninhabited stretches of steppe and plateau, roamed over by nomadic tribes—has kept many of the tribes untouched by contact with the outside world, many of their names being now heard of for the first time. In the area of inland drainage their variety is extraordinary. Hamitic in physical type, though of a "Nilotic" speech, are the Masai and their near allies, the Wataturu. The former seem destined to extinction from their want of intelligence, and of power to adapt themselves to life as agriculturalists. The tribe is already decimated by the effect of the cattle-plague. The Wataturu, formerly cattle-rearing nomads, have been compelled by the loss of their cattle to take to agriculture, though but a small number still survive. The Wafiomi, agriculturalists living south of Lake Manyara, speak a unique language, and seem to represent the oldest Hamitic immigration. They live in singular underground dwellings, apparently a modification of the flat-roofed "tembe," itself adopted as less exposed to fire during the attacks of the Masai than other forms. The Wambugwe and Wanyaturu are Bantu immigrants, the former from the south, the latter from the north; while the Wanege are of doubtful origin, but the richness of their language in "clicks" suggests a connection with the Bushmen, or Pygmies. They are a primitive, probably aboriginal, hunting tribe.

The tribes near the Nile sources do not show such a variety, being almost exclusively Bantu and agriculturalists, with the exception of the Watussi, a Hamitic race scattered through the countries west of the Victoria Nyanza. While forming the ruling class in Uganda and elsewhere, in other parts they form a caste of cattle-rearers. Their cattle, marked by the great development of horns, is allied, according to Dr. Adametz, to the "Sanga" of Abyssinia, which confirms the belief in the derivation of the tribe from those parts.* The Bantu tribes on the east and west of the Victoria Nyanza appear to have come from the north, while the Wanyamwesi advanced from the south and separated the two branches of northern immigrants. In speech the Wazinja, etc., west of the lake are related to the Wanyoro, but physically they have felt the influence of the Watussi, who have themselves, however, adopted the speech and mode of life of the peoples among whom they live. The Warundi have been little touched by northern influence. Among them dwell the Watwa, apparently allied to the dwarfs of the Congo forest.

* As the original home of the Hamites is believed to have been in Asia, so a resemblance has been traced between the skull of the Sanga and one of the varieties of the Indian Zebu.

Dr. Baumann deals in a sensible way with the question of the economic prospects of the country. He insists especially on the necessity of looking forward to the future, as the present products of the country, ivory and slaves, will before long cease to be so, and the present trade route *viâ* Tabora already shows signs of decadence. Agriculture must, therefore, in the main, supply the commerce of the future. Vast expanses of fertile plateau-lands are eminently suited for this purpose, but they are at present unpeopled. The author builds great hopes on a systematic settlement of Wanyamwesi, the most enterprising and intelligent tribe of East Africa, in colonies in suitable localities. This must precede all thought of European settlement. The line which he favours for a railway is that passing south of Kilimanjaro, and *viâ* the Masai plateau to Speke Gulf, as opening the greatest extent of country likely to repay enterprise in the future. The physical difficulties would be less than in the case of the English scheme, while the presence of the suggested colonies would be an immense help towards the carrying out of the undertaking.

Cartographic Results of Dr. Baumann's Journey in East Africa.—The four-sheet map which Dr. Baumann has constructed, in conjunction with Dr. B. Hassenstein, from the results of his own surveys combined with previously existing material, has appeared as a supplementary number of *Petermanns Mitteilungen* (No. III.), accompanied by critical remarks on the methods employed in the surveys, and the amount of reliance to be placed on the newly-fixed positions in this part of Africa. Besides the route survey with watch and compass, supplemented by rounds of bearings of prominent objects, Dr. Baumann devoted much attention to astronomical observations, the results of which have been calculated by Dr. L. Ambronn. For a great part of the region traversed they supply for the first time a basis for the accurate construction of a map, and although the exclusive use of the sun for the determination of time and latitude has caused some of the work to be of less value than otherwise, it is pronounced to be, on the whole, an exceedingly valuable contribution to African cartography. The surveys of Captain Spring and Lieut. Werther have also been embodied, and Dr. Hassenstein gives a short *résumé* of the whole body of material available for the mapping of the region in question.

DR. G. M. DAWSON'S OBSERVATIONS ON THE BERING SEA.

In 1891 Dr. Dawson visited the Bering Sea as one of the British Commissioners in the fur-seal investigations, and on that occasion he made many geological notes, which he has published in the Bulletin of the Geological Society of America (v. 117–146). The Bering Sea, like the Seas of Okhotsk and Japan, is enclosed by an arc of islands, but communicates with the Arctic Sea on the north, as well as with the Pacific. Soundings show, however, that while the south-western part of the sea is very deep (1000 to 2000 fathoms), the north-eastern or Bering Strait region is never more than 100, and is commonly not over

50 fathoms deep; so that an elevation of some 300 feet would raise this continental shelf and unite Asia and America, enclosing the Bering Sea on the north. The Siberian coast has fjord-like inlets at Plover Bay (64° 30′), and behind are bold mountains about 4000 feet high, probably granitic. The land is grey or brownish grey, treeless, and bare except for some green herbage in the valleys. St. Lawrence Island, at the mouth of Bering Strait, is the largest in those regions, being 85 miles long. The granitic rocks have been broken up, as they are on the summits of high hills like Ben Nevis, and cover the surface except in a few places where moorland or grass occurs. The other islands on this continental shelf are of old volcanic origin without modern cones, and treeless, although occasional stunted shrubs grow in the valleys and on the grassy surfaces. No traces of raised beaches nor of glaciation were observed. The Kamchatka peninsula has numerous active volcanoes, several of which are over 10,000 feet high, with snow-covered upper slopes. Below them there is a hilly country, which must have been subject to denuding forces for a very long period. At Cape Chipunski there is evidence of a plane of marine denudation at 600 to 800 feet, and the valleys which cut through the underlying rocks end abruptly 50 to 100 feet above the present level; so that there has probably been a depression of 600 to 800 feet, followed by an elevation to within 50 to 100 feet of the present level, which has subsequently been raised. St. Matthew Island on the Bering shelf has every appearance of being the unsubmerged remnant of hills like those of Kamchatka.

The Commander Islands form the western part of the chain of islands enclosing the Bering Sea; they appear never to have been visited until the Russians discovered them in 1741. Bering Island is 95 nautical miles from the Kamchatka shore, is 50 miles long, and is separated from Copper Island by a channel of 26 miles. The northern part of Bering Island, 20 miles in breadth, is tundra-like, but the narrower southern part is hilly, rising to 1000 feet. Copper Island is a single mountain range, 30 miles long and 5 miles broad, formed of volcanic rocks, but without a trace of crater or cone. Terraces occur at Glinka village up to 600 or 700 feet. Copper is found in the island, usually in nuggets or pellets along the coast. The climate is cool and moist and less rigorous than in the east of the Bering Sea for the same latitude. There are no shrubs nor trees, but luxuriant herbs and grasses grow where there is soil. The Russians have several settlements on both islands, but most of them are broken up in winter.

The Aleutian Islands are separated from the Commander group by a wide and very deep channel. They crown a sharp submarine ridge, the 1000-fathom contour clinging close to the shore on both sides of the chain for half its length, but at the east end they rise from the continental shelf as a continuation of the Alaskan peninsula. Volcanic

activity seems past its most active period in those islands, for no tapering cones like those of Kamchatka now exist, and most of the hills have been rounded by denudation. The most western island, Attu, rises to 3084 feet, and, like the other islands also, it has steep grassy slopes. A faint horizontal line is indicated at 300 feet, where the old sea cliffs rise above a gravelly flat 20 to 30 feet high. In the more eastern islands there is no trace of beach-lines. The hills are covered with snow, the exposed rocks are coloured, and the herbage a vivid green, but trees grow nowhere. There are no traces of glaciation.

The most important fossils from a geographical point of view are those of the mammoth, found on the Pribilof group and on Unalaska of the Aleutians. Mammoth remains have been found in various other parts of Alaska, but always in the flat, unglaciated part; and this localization of the distribution of these fossils points to the past land connection of Asia and America, which a change of level of only 300 feet might have brought about.

There was no polar ice-cap in these regions, and the nearest glacier was that of the Cordillera, stretching 1200 miles along the Rocky Mountains, from 48° to 63° N., and extending to a breadth of 400 miles. Dr. Dawson has now traced out not only the south-eastern but also the north-western flow of this ice. Middleton, a small island near Prince William Sound, consists entirely of boulder clay, and probably is of morannic origin, and at the seaward edge of the Cordilleran ice-field.

THE PHYSICAL CONDITION OF THE OCEAN.*

You will not be surprised if, having called upon an hydrographer to preside over this Section, he takes for the subject of his review the Sea. Less apparently interesting, by reason of the uniformity of its surface, than the land which raises itself above the level of the waters, and with which the term geography is more generally associated, the ocean has, nevertheless, received much attention of later years. In Great Britain, especially, which has so long rested its position among the nations upon the wealth which our merchant fleets bring to its shores, and upon the facilities which the sea affords for communication with our numerous possessions all over the globe, investigation into the mysteries, whether of its ever-moving surface or of its more hidden depths, has been particularly fascinating. I purpose, therefore, to attempt a brief survey of our present knowledge of its physical condition.

The very bulk of the ocean, as compared with that of the visible land, gives it an importance which is possessed by no other feature on the surface of our planet. Mr. John Murray, after a laborious computation, has shown that its cubical extent is probably about fourteen times that of the dry land. This statement appeals strongly to the imagination, and forms, perhaps, the most powerful argument in

* Address to the Geographical Section of the British Association, by Captain W. J. L. Wharton, R.N., F.R.S., President of the Section, Oxford, August 9, 1894.

favour of the view, steadily gaining ground, that the great oceans have in the main existed in the form in which we now see them since the constituents of the earth settled down into their present condition. When it is considered that the whole of the dry land would only fill up one-third of the Atlantic Ocean, the enormous disproportion of the two great divisions of land and sea becomes very apparent.

The most obvious phenomenon of the ocean is the constant horizontal movement of its surface waters, which in many parts take well-defined directions. These great ocean currents have now been studied for many years, and our knowledge of them is approaching a point beyond which it is doubtful whether we shall ever much advance, except in small details. For though, while indisputably the waters continually move in each great area in generally the same direction, the velocities vary, the limits of the different streams and drifts vary, mainly from the ever-varying force and direction of the winds. After long hesitation and much argument, I think it may be now safely held that the prime motor of the surface current is the wind. Not, by any means, the wind that may blow, and even persistently blow, over the portion of water that is moving, more or less rapidly, in any direction, but the great winds which blow generally from the same general quarter over vast areas. These, combined with deflection from the land, settle the main surface circulation.

I do not know if any of my hearers may have seen a very remarkable model, devised by Mr. Clayden, in which water disposed over an area shaped like the Atlantic, and sprinkled over with lycopodium dust to make movement apparent, was subjected to air impelled from various nozzles, representing the mean directions of the permanent winds. It dispelled the last doubt I held on the subject, as not only were the main currents reproduced, but the smaller effects and peculiarities of the Atlantic drifts were produced with surprising accuracy.

There is a small current, long shown on our charts, but which I had always regarded with suspicion. I refer to the stream which, after travelling from the Arctic Ocean southward along the east coast of Greenland, turns sharply round Cape Farewell to the northward into Davis Straits, where it again doubles sharply on itself to the southward. This is exhibited, in the model, in all its details, and is evidently caused by the pressure of the water forced by the mimic Gulf Stream into the Arctic region, where it has no escape except by this route, and is pressed against the land, round which it turns as soon as it can. This is, no doubt, the explanation of the real current. The very remarkable winter equatorial current, which runs in a narrow belt eastwards, just north of the main stream travelling west, was also reproduced with extraordinary fidelity.

The winds, however, that are ordinarily considered permanent vary greatly, while in the monsoon areas the reversal of the currents caused by the opposite winds exercise a great influence on the movements of the water far beyond their own limits, and anything like a prediction of the precise direction and rate of an oceanic stream can never be expected. The main facts, however, of the great currents can be most certainly and simply explained in this manner. The trade winds are the prime motors. They cause a surface drift of no great velocity over large areas in the same general direction as that in which they blow. These drifts, after meeting and combining their forces, eventually impinge on the land. They are diverted and concentrated, and increase in speed. They either pour through passages between islands, as into the Caribbean Sea; are pressed up by the land, and escape by the only outlets possible—as, for example, the Strait of Florida, and form a great ocean current like the Gulf Stream—or, as in the case of the Agulhas current and the powerful stream which runs north along the Zanzibar coast, they are simply pressed up against and diverted by the land, and run along it with

increased rapidity. These rapid currents are eventually apparently lost in the oceans, but they in their turn originate movements of a slower character, which, on again passing over shallow water or on meeting land, develop once more into well-defined currents.

We find an analogous state of things on the western side of the Pacific, where the Japan current is produced in a similar manner.

The fact that on all western shores of the great oceans towards which the trade winds blow we find the strongest currents running along the coast, is almost enough of itself to prove the connection between them. The westerly winds that prevail in higher northern and southern latitudes are next in order in producing great currents. From the shape of the land, they in some cases take up and continue the circulation commenced by the trade winds; in others they themselves originate great movements of the water. Compared to the great circulation from this source the effect of differences of temperature or of specific gravity is insignificant, though no doubt they play their part, especially in causing slow under-circulation, and in a greater degree the vertical mixing of the lower waters. No drop of the ocean, even at its greatest depth, is ever for one moment at rest.

Dealing with minor points, the American officers of the Coast and Geodetic Survey have found, after long and patient investigation, that the velocity of the Gulf Stream in its initial and most marked part, the Strait of Florida, is greatly affected by the tide, varying as much as one-half its maximum rate during the twenty-four hours. These American investigations are of greatest interest. They have extended over the whole area of the Caribbean Sea and its approaches, the Gulf of Mexico, and the Gulf Stream proper and its vicinity. In no other part of the ocean has observation of this detailed character been carried out, and they throw a great light on oceanic circulation. The *Blake*, the vessel specially fitted for the purpose, has during the several years in which she was employed on this work anchored in over 2000 fathoms of water, or a depth of considerably more than two miles; a feat which would a short time ago have been deemed impossible. One great point that has come out very strongly is the continual variation in the strength and direction of the currents, and the varying depths to which the surface current extend.

Eastward of the chain of the Windward Islands the general depth of the surface movement may be said to be about 100 fathoms, below which tidal influence is very distinct. There is also a very plain backward flow of water, at depths which vary, caused by the submarine ridge which connects the Windward Chain of the West Indian Islands. These observations also generally support what I have already mentioned; that the velocity of a current depends on the strength of winds, possibly thousands of miles distant, which have given the original impetus to the water, and this, combined with tidal action when the current approaches or runs along a coast, will always cause uncertainty on the resultant velocity.

Dealing for yet another moment with the Gulf Stream, there are two points which have not been much dwelt upon, but which have a great effect on its power of bringing the modifying influence of its warm water as far as our shores. The first is the prevention of its spreading, as it leaves the Strait of Florida, by the pressure of the portion of the equatorial current which, unable to get through the passages between the Windward Islands, is diverted to the north of the Bahamas, and bears down on the eastward side of the Gulf Stream proper, compressing it between itself and the cold water flowing southward along the American coast, and at the same time adding to its forces and maintaining its high temperature. The second is that by the time the Gulf Stream has lost its velocity as a current, in about the vicinity of the Bank of Newfoundland, it has arrived in the region of the

westerly winds—that is, of winds whose average direction is from west—whose influence, causing a surface drift somewhat comparable to that of the trade winds, bears the water onward to the British Islands and Norway. Without these prevailing westerly winds the warm water of the Gulf Stream would never reach these shores.

The depth to which the surface currents extend in other parts is little known. Direct observations on under-currents have been rare. In the first place, it is not an easy observation to make. Apparatus has generally to be improvised. This has usually consisted of some form of flat surface lowered to the required depth, and suspended in the water by a buoy, which presents to the resistance of the upper stratum a very much smaller area than that of the surface below. More perfect machines have been devised, notably, that used by the Americans in their West Indian experiments. These, however, are delicate, and require so much care and experience in working, and so much time is wanted for such observations, that under the pressure of the more urgent requirements on surface movements in the interests of navigation very little has been done. The *Challenger* made some observations on the depth of the equatorial current in mid-Atlantic, but they were not very conclusive for lack of suitable appliances. They, however, tended to show that below 100 fathoms there was but little current.

It has been calculated theoretically that winds blowing steadily in one direction with the ordinary force of the trade winds would in 100,000 years by friction between the particles put the whole of a mass of water 2000 fathoms deep, not otherwise influenced, into motion in that direction; but the direction and force of the trade winds are ever changing, and the actual strong currents of the ocean are not in the trade wind areas, but are the result of these drifts meeting one another and being compressed by the conformation of the land. We cannot, therefore, expect this theoretical effect to be realized.

One instance of the underrunning of one current by another is brought very plainly to our notice in the North Atlantic, to the east of the Great Banks of Newfoundland, where the icebergs borne by the arctic current from Baffin Bay pursue their course to the southward across the Gulf Stream running eastward. These great masses of ice floating with seven-eighths of their volume under the surface, draw so much water that they are all but wholly influenced by the under-current. A large berg will have its bottom as much as 600 or 700 feet below the surface. The only reason that these bergs continue their journey southward is the action of the cold under-current.

It was my good fortune to be ordered in 1872 to undertake a series of experiments of the currents and under-currents of the Dardanelles and Bosporus. They proved most interesting. It was well known that a surface stream is almost continuously passing out of the Black Sea through the Bosporus into the Sea of Marmara, and again through the Dardanelles into the Mediterranean. Certain physicists, of whom Dr. W. Carpenter was one, were, however, of opinion that a return current would be found under the surface running in the opposite direction, and this I was enabled to demonstrate. Though from the imperfection of our apparatus, which we had to devise on the spot, we were unable to exactly proportionate the quantities of water moving in the two directions, we found, whenever the surface current was rushing south-westward through these straits, that for a certain distance, from the bottom upwards, the water was in rapid motion in the opposite direction. It was an astonishing sight to behold the buoys, which supported a wooden framework of 36 square feet area, lowered to depths from 100 to 240 feet, tearing up the straits against a strong surface current of as much as 3 and 4 miles an hour. It was as perfect an ocular demonstration of a counter under-current as

could be wished, and the Turks, who watched our proceedings with much suspicion, were strongly of opinion that the devil had a hand in it, and only the exhibition of the Sultan's firman saved us from interruption. In the investigation of these currents we found, as usual, that the wind was the most potent agent. Though the surface water from the Black Sea is almost fresh, and the bottom water of the heavy Mediterranean density of 1·027, it was found that when calm had prevailed the surface current slackened, and at times became nil, whilst the under-current responded by a similar slackening.

The ordinary condition of wind in the regions of the Black Sea and Sea of Marmara is that of a prevalent north-east wind. This causes a heaping up of the water on the south-west shores of those seas, precisely where the straits open, and the surface water therefore rapidly escapes. These straits no doubt present abnormal characters, but, so far as surface currents are concerned, the long series of observations then made convinced me of the inadequacy of differences of specific gravity, which were here at a maximum, to cause any perceptible horizontal flow of water. I have said that we were unable to define by direct observation the exact position of the dividing line between the opposing currents, but the rapid change in the specific gravity at a certain depth, which varied on different days, gave a strong indication that the currents changed at this point. A Russian officer, Captain Makaroff, afterwards made similar experiments in the Bosporus, but with more perfect appliances, and he found that at the point where the specific gravity changed the currents also changed.

I have been anxious to obtain similar observations at the Straits of Babel Mandeb, the southern outlet of the Red Sea, where somewhat similar conditions prevail. Here the winds are governed by the monsoons. For half the year the wind blows from the north down the whole length of the sea, causing a surface flow outwards into the Gulf of Aden, and a general lowering of the whole level of the sea of about 2 feet. For the other half of the year the wind at the southern end of the sea is strong from the south-east, causing a surface set into the Red Sea, over which the general level of the water rises, while the northerly wind continues to blow throughout the northern half. At either of these times I think it is highly probable that there is an undercurrent in the opposite direction to that at the surface, but unfortunately the sea disturbance is great and observations are very difficult. Observations were, however, made by Captain W. U. Moore in H.M.S. *Penguin*, in 1890, but at a time when the change of monsoon was taking place. The result was peculiar, for it appeared that at a depth of about 360 feet the movement of the water was tidal, while the surface water was moving slowly in one direction—a result generally similar to that obtained by the Americans in the West Indies—but the direction of the tidal flow was directly opposite to what might have been expected, viz. the water ran in while the tide fell, and *vice versâ*. More observations are, however, needed here before any certain conclusions can be formed.

The depth of the ocean is the next great feature which demands attention. On this our knowledge is steadily, though slowly, increasing. The whole of it has been gained during the last fifty years. Commenced by Sir James Ross, whose means were very small, but who nevertheless demonstrated that the so-called unfathomable ocean was certainly fathomable everywhere, the sounding of the ocean has continuously proceeded. The needs of submarine cables have constantly demanded knowledge in this particular, and the different cable companies have had a large share in ascertaining the facts. Expeditions, whose main object has been to obtain soundings, have been sent out, Great Britain and the United States taking the first place; but most maritime nations have aided. In the immediate

past the additions have mainly been from the soundings which H.M. surveying ships continually take whenever on passage from one place to another, from the work of our cable companies, and from United States vessels. We have, as a result, a very fair general knowledge of the prevailing depths in the Atlantic, but of the Indian and Pacific Oceans it is very fragmentary. We have enough to give us a general idea, but our requirements increase as years roll on. It is a vast task, and, it may be safely said, will never be completed; for we shall never be satisfied until we know the variations of level under the water as well as we know those on the dry land.

It is hopeless to do more than to briefly sketch the amount of our knowledge. First, as to the greatest depths known. It is very remarkable, and from a geological point of view significant, that the very deepest parts of the ocean are not in or near their centres, but in all cases are very near land. One hundred and ten miles outside the Kurile Islands, which stretch from the northern point of Japan to the north-east, the deepest sounding has been obtained of 4655 fathoms, or 27,930 feet. This appears to be in a deep depression, which runs parallel to the Kurile Islands and Japan; but its extent is unknown, and may be very large. Seventy miles north of Porto Rico, in the West Indies, is the next deepest cast known, viz. 4561 fathoms, or 27,366 feet; not far inferior to the Pacific depth, but here the deep area must be comparatively small, as shallower soundings have been made at distances 60 miles north and east of it. A similar depression has been sounded during the last few years west of the great range of the Andes, at a distance of 50 miles from the coast of Peru, where the greatest depth is 4175 fathoms. Other isolated depths of over 4000 fathoms have been sounded in the Pacific. One between the Tonga or Friendly Islands of 4500 fathoms, one of 4478 fathoms near the Ladrones, and another of 4428 fathoms near Pylstaart Island, all in the Western Pacific. They all require further investigation to determine their extent. With these few exceptions, the depth of the oceans, so far as yet known, nowhere comes up to 4000 fathoms, or four sea miles; but there can be little doubt that other similar hollows are yet to be found.

The sea with the greatest mean depth appears to be the vast Pacific, which covers 67 millions of the 188 millions of square miles composing the earth's surface. Of these 188 millions, 137 millions are sea, so that the Pacific comprises just one-half of the water of the globe, and more than one-third of its whole area. The Northern Pacific has been estimated by Mr. John Murray to have a mean depth of over 2500 fathoms, while the Southern Pacific is credited with a little under 2400 fathoms. These figures are based on a number of soundings which cannot be designated otherwise than very sparse.

To give an idea of what remains to be done, I will mention that in the eastern part of the Central Pacific there is an area of 10,500,000 square miles in which there are only seven soundings, whilst in a long strip crossing the whole North Pacific, which has an area of 2,800,000 square miles, there is no sounding at all. Nevertheless, while the approximate mean depth I am mentioning may be considerably altered as knowledge increases, we know enough to say that the Pacific is generally deeper than the other oceans. The immensity, both in bulk and area, of this great mass of water is difficult to realize; but it may assist us when we realize that the whole of the land on the globe above water-level, if shovelled into the Pacific, would only fill one-seventh of it. The Indian Ocean, with an area of 25,000,000 square miles, has a mean depth, according to Mr. Murray, of a little over 2000 fathoms. This also is estimated from a very insufficient number of soundings. The Atlantic, by far the best-sounded ocean, has an area of 31,000,000 square miles, with a mean depth of about 2,200 fathoms.

The temperature of this huge mass of water is an interesting point. The temperature of the surface is most important to us, as it is largely on it that the climates of the different parts of the world depend. This is comparatively easy to ascertain. We know so much about it that we are not likely to improve on it for many years. We are quite able to understand why countries in the same latitude differ so widely in their respective mean temperatures; why fogs prevail in certain localities more than others; and how it comes about that others are subject to tempestuous storms. On the latter point nothing has come out plainer from recent discussion than the fact that areas where great differences of surface temperature of the sea prevail are those in which storms are generated. It is a matter of observation that in the region south of Nova Scotia and Newfoundland many of the storms which travel over the Atlantic to this country have their rise. An examination of surface temperature shows that in this region the variations are excessive, not only from the juxtaposition of the warm water of the Gulf Stream and the cold water of the Arctic current flowing southward inside of it, but in the Gulf Stream itself, which is composed of streaks of warm and colder water, between which differences of as much as 20° Fahr. exist. The same conditions exist south of the Cape of Good Hope, another well-known birthplace of storms. Here the Agulhas-current of about 70° Fahr., diverted by the land, pours into the mass of water to the southward, colder by some 25°, and the meeting-place is well known as most tempestuous. South-east of the Rio de la Plata is another stormy area, and here we find the same abnormal variations in surface temperature. Yet another is found off the north-east coast of Japan with the same conditions. These differences are brought about by the mingling of water carried either by the flowing of a powerful current turned by the land into a mass of water of different temperature, as is the case off the Cape of Good Hope, or by the uprising of lower strata of cooler water through a shallow surface stream, as appears to be the case in the Gulf Stream.

A remarkable point recently brought to light by the researches of Mr. John Murray in Scotch lochs is the effect of wind on the surface temperature. It has been observed that wind driving off a shore drifts the surface water before it. This water is replaced by the readiest means, that is to say, by water from below the surface rising to take its place. As the lower strata are in all cases cooler than the surface, a lowering of the temperature results, and we find, in fact, that near all sea-shores off which a steady wind blows the water is cooler than further to seaward. This has an important bearing on coral-growth, and explains why on all western coasts of the great continents off which the trade winds blow we find an almost absolute dearth of coral, while on the eastern coasts, on which warm currents impinge, reefs abound, the coral animal flourishing only in water above a certain temperature.

Observations of the temperature of the strata of water between the surface and bottom have been of late years obtained in many parts. Compared with the area of the oceans they are but few, but our knowledge steadily increases every year. The subject of the vertical distribution of temperature has not yet been thoroughly investigated in the light of the whole of the information which we now possess, but Dr. Alex. Buchan has been for some time devoting his spare time to the task, and it is a heavy labour, for the data obtained here and there over the world by different ships of all maritime nations are very difficult to collect and to appraise, but I understand that before long we shall have the result, which will prove very interesting, in the last volume of the *Challenger* series.

It will readily be understood that observations on temperatures at great depths require great care. In the first place, the thermometers must be most carefully

manufactured. They must be subjected to rigorous tests, and they must be carefully handled during the operation. All observations are not of the same value, and the discussion, therefore, presents considerable difficulty and demands much discretion. In the mean time we can state certain known facts. We have learnt that the depth of the warm surface water is small. In the equatorial current between Africa and South America, where the surface is of a temperature of 78°, at 100 fathoms it is only 55°, a difference of 23°, and a temperature of 40° is reached at 400 fathoms. In this region, so far as knowledge goes, the fall in temperature as we descend is most rapid, but generally speaking the same variations prevail everywhere. In the tropical Pacific the temperature falls 32° from the surface, where it stands at 82°, to a depth of 200 fathoms, 40° being reached at from 500 to 600 fathoms below the surface. Below the general depth of 400 to 600 fathoms, the temperature decreases very slowly, but there is considerable variation in the absolute amount of it when we get to great depths in different parts of the ocean.

One of the most interesting facts that has been recognized is, that in enclosed hollows of the ocean the bottom temperature is apparently much less than that of the stratum of water at a corresponding depth in the waters outside the submarine ridge that forms the enclosing walls, separating them from deeper areas beyond; and is, in all cases that have been observed, equal to that on the ridge. From this fact we are enabled to supplement our imperfect knowledge of depths, because if, in a certain part of an ocean, we find that the temperature at great depths is higher than we know exists at similar depths in waters apparently connected, we can feel certain that there is a submarine ridge which cuts off the bottom waters from moving along, and that the depth on this ridge is that at which is found the corresponding temperature in the outer waters. As a corollary we also assume that the movement of water at great depths is confined to an almost imperceptible movement, for if there was a motion that we could term, in the ordinary acceptation of the word, a current, it would infallibly surmount a ridge and pour over the other side, carrying its lower temperature with it. A notable instance is the bottom temperature of the North Atlantic. This is nowhere below 35° Fahr., although the depths are very great. But in the South Atlantic, at a depth of only 2800 fathoms the bottom temperature is but a little above 32° Fahr., and we are therefore convinced that somewhere between Africa and South America, though soundings do not yet show it, there must be a ridge at a depth of about 2,000 fathoms. We also come to the same conclusion with regard to the eastern and western portions of the South Atlantic, where similar differences prevail. Again, the few temperatures that have been obtained in the eastern South Pacific show a considerable difference from those in the South Atlantic, and we are compelled to assume a ridge from the Falkland Islands to the Antarctic continent.

It is interesting that the investigation into the translation of the great seismic wave caused by the eruption of Krakatoa in 1883 led to a similar and entirely independent conclusion. The wave caused by the explosion in the Straits of Sunda reached Cape Horn, where by good chance a French meteorological expedition had erected an automatic tide-gauge, but instead of one series of waves being marked on the paper there were two. A little consideration showed that, the South Pole having directly interposed between Sunda Straits and Cape Horn, the waves diverted by the land about the pole would arrive from both sides. One wave, however, made its appearance seven hours before the other. Study showed that the earliest wave coincided in time with a wave travelling on the Pacific side of the pole, with a velocity due to the known depth, while the later wave must have been retarded in its journey *viâ* the South Atlantic. The only possible explanation is that the wave had been impeded by comparatively shallow water. The evidence

from bottom temperature was then unknown, and thus does one branch of investigation aid another.

In the Western Pacific the water is colder, a few bottom temperatures of a little over 33° Fahr. having been found in the deep trough east of the Tonga Islands; but the North Pacific, though the deeper ocean—of enormous area and volume—is apparently again cut off by a submarine ridge. The north-western part of the Indian Ocean is for similar reasons assumed to be divided from the main body, the shallower water probably running from the Seychelles to the Maldive Islands.

Mr. Buchanan has pointed out why some parts of oceans, deep and vast though they be, are, when cut off from communication with others, warmer at the bottom. Water can only sink through lower layers when it is the heavier, and though a warm surface current becomes from evaporation denser, its heat makes it specifically lighter than the strata below. It is only when such a current parts gradually with its heat, as in travelling from tropical to temperate regions, that it sinks and slowly but surely carries its temperature with it, modifying the extreme natural cold of the bottom layers. In the North Atlantic and Pacific we have such a condition. The great currents of the Gulf Stream and Japan current, as they flow to the north, sink, and in the course of ages have succeeded in raising the bottom temperature three or four degrees. In the southern seas this influence is not at work, and, directly connected with the more open water round the South Pole, there is nothing to carry to the abysmal depths any heat to raise them from their normal low temperatures, due to the absence of any heating influence. The ice masses round the South Pole have probably little or no effect on bottom temperature, as the fresher, though colder, water will not sink; and, as a matter of fact, warmer water is found at a few hundred fathoms than at the surface. The lowest temperature ever obtained was by Sir John Ross in the Arctic Ocean in Davis Straits at a depth of 680 fathoms, when he recorded a reading of 25° F. This probably requires confirmation, as thermometers of those days were somewhat imperfect. In the great oceans the greatest cold is found on the western side of the South Atlantic, where the thermometer stands at 32·3° Fahr., but temperatures of 29° Fahr. have been obtained of recent years east of the Færoe Islands, north of the ridge which cuts off the deeper waters of the Arctic from the Atlantic.

Though scarcely within the limits of my subject, which is the sea itself, I must say a few words on the sea floor. The researches carried on in the *Challenger* revealed that, while for a certain distance from the continents the bottom is composed of terrestrial detritus, everywhere in deep water it is mainly composed of the skeletons or remains of skeletons of the minute animals that have lived in the water. In comparatively small depths we find remains of many shells. As the depth increases to 500 fathoms or so we get mainly the calcareous shells of the globigerinæ, which may be said to form by far the greater part of the oceanic floor. In deeper water still, where pressure, combined with the action of the carbonic acid, has dissolved all calcareous matter, we find an impalpable mud with skeletons of the silicious radiolaria of countless forms of the greatest beauty and complexity. Deeper still, *i.e.* in water of—speaking generally—over 3000 fathoms, we find a reddish-coloured clayey mud, in which the only traces of recognizable organic remains are teeths of sharks and cetacea, many belonging to extinct species. What the depths of these deposits may be is a subject of speculation. It may be that some day, as mechanical appliances are improved, we shall find means of boring, but up to the present no such operation has been attempted.

On the specific gravity of the water of the sea I can say but little except that it varies considerably. It is not yet known for certainty how far the specific gravities observed at various points and depths remain appreciably constant. In

localities where evaporation is great, and other influences do not interfere, it is evident that the specific gravity of the surface will be high; a consideration which observations confirm, but there are many complications which require more observation before they can be resolved. In some few places repeated observations permit deductions, but, taking the sea as a whole, we are yet very ignorant of the facts bearing on this point.

The waves which for ever disturb the surface of the sea demand much study. The greatest of these, and the most regular, is the tidal wave. On this many powerful intellects have been brought to bear, but it still presents many unsolved anomalies. Lord Kelvin and Professor Darwin have demonstrated that the tidal movement is made up of many waves depending upon different functions of the moon and sun, some being semi-diurnal, some diurnal. The time of transit over the meridian, the declination of both bodies, create great variations; the changing distance and position of the moon and the position of her node also have great effect, while the ever-varying direction and force of the winds, and the different pressure of the atmosphere play their part, and sometimes a very large part, on what is somewhat loosely known as the meteorological tide. The amplitude of the oscillation of the water depending upon each of the astronomical functions varying for every point on the earth, the effect is that, each having a different period, the resulting mean movement of the water has most astonishing variations. In some places there is but one apparent tide in the day; in others this phenomenon only occurs at particular periods of each lunation, while in the majority of cases it is the movements of each alternate tide only that appear to have much to do with one another. Though after long observation made of the times and ranges of tides at any one spot, they can now be predicted with great accuracy, for that particular place, by the method of harmonic analysis, perfected by Professor G. Darwin, the meteorological tide excepted, no one can yet say what the tide will be at any spot where observations have not been made.

Observations all over the world have now shown that there is no part where the tidal movement is so regular and simple as around the British islands. This is more remarkable when it is found that the tides on the other side of the Atlantic—at Nova Scotia, for instance—are very complicated. The minor tides, which in most parts of the world, when combined in one direction, amount to a very considerable fraction of the principal lunar and solar tides, and consequently greatly increase or diminish their effects, are in Great Britain so insignificant that their influence is trifling; but why this should be I have never yet found any one to explain. Nevertheless there are many very curious points about our tides which are plainly caused by interference, or, in other words, by the meeting of two tidal waves arriving from opposite directions, or from the rebound of the tidal waves from other coasts. This effect, also, it has been so far found impossible to predict without observation. On our southern coasts, for instance; in the western part the tide rises about 15 feet, but as it travels eastward the range becomes less and less until, about Poole, it reaches a minimum of 6 feet. Further east again it increases to Hastings, where the range is 24 feet. Yet further east it again gradually diminishes. This is due to the reflection from the French coast, which brings another wave which either superposes itself upon, or reduces the effect of, the main tide advancing up the English Channel; but the details of such reflection are so complex that no one could forecast them without more knowledge than we possess. There can be little doubt that to this cause, reflection, is mainly due the variations in the amount of mean range of tide which are found on many coasts at different parts; and as these reflected waves may arrive from great distances, and be many

in number, we may cease to wonder at the extraordinary differences in range of tide which prevail, though it will be understood that this is wholly separate from the varying heights of each successive tide, or of the tide at different parts of each lunation, or at different times of the year, which depend upon the astronomical influences.

The actual height of the tide in deep water is small, but on passing into shallow water when approaching a shore, and especially when rolling up a gulf of more or less funnel shape, it becomes increased by the retardation caused by friction, and by compression laterally, and hence the height of the tide on a coast affected by other causes is greater than in the open sea. The oceanic tide wave is supposed to be from 2 to 3 feet in height, but as this has been assumed from observations made at small oceanic islands where, although the magnifying influences mentioned are at a minimum, they still exist, we wait for precise information until some means of actually measuring the tide in deep water is devised.

The waves due to wind, though not so far-reaching in their effects as the majestic march of the tide wave, are phenomena which are more apparent to the traveller on the ocean. The deep sea in a heavy gale presents, perhaps, the most impressive manifestation of the powers of nature which man can behold, and doubtless many of us have experienced feelings that may vary from awe and wonder to sheer delight, according to the temperament of each individual, at for the first time finding himself face to face with this magnificent sight, though I rather fear that discomfort is the prevailing feeling that many carry away. The height to which storm waves may rise has never been very satisfactorily determined. Apart from the difficulty of the task and the small number of people who will address themselves to it when they have the chance, it is but rarely that any individual sees really abnormal waves, even though he may be at sea all his life. Different heights for what are called maximum waves have been recorded, and they vary from 40 to 90 feet from crest to hollow. All we can say is that the most probable figure is about 50 or 60 feet. These great storm waves travel very far. In some cases they convey a warning, as their velocity always far exceeds that at which the storm is travelling. In others they intimate that a gale of which no more is seen has occurred somewhere—it may be many miles distant. When they have travelled beyond the limits of the wind which raised them, they lose the steepness of slope which characterizes them when under its influence, and become an undulation which is scarcely noticed when in deep water. On approaching shallow water, however, they are again apparent, and the "rollers" that occur unperiodically at various places in latitudes where gales never occur would seem to be caused by such waves, originating in areas many thousands of miles distant. Such appears to be the origin of the well-known rollers at Ascension and St. Helena, where the rocky and exposed nature of the landing has caused this phenomenon to be especially noticed.

Other rollers are, however, undoubtedly due to earthquakes or volcanic eruptions occurring in the bed of the sea. Many of the great and sudden waves which have caused devastation and great loss of life on the shores of western South America are referable to this cause. Observations to enable the focus of such a disturbance to be traced have generally been lacking, but it is probable that where the wave has been large the point of origin has not been far distant. In one notable instance the conditions were reversed. The point of origin was known and the distance to which the resulting wave travelled could be fairly satisfactorily traced. This was the great eruption in the Straits of Sunda, in August, 1883, which locally resulted in the disappearance of the major part of the island of Krakatoa, and the loss of nearly 40,000 lives, on the neighbouring shores of Java and

Sumatra, by the huge wave which devastated them. The records of automatic tide-gauges and the observations of individuals enabled the waves emanating from this disturbance to be followed to great distances. These waves were of great length, the crests arriving at intervals of about an hour, and moving with a velocity of about 350 miles an hour, were about that distance apart. The waves recorded at Cape Horn were apparently undoubtedly due to the eruption, and travelled distances of 7500 miles and 7800 miles in their course on either side of the south polar land. They were only 5 inches in height above mean level of the sea, while the waves recorded at places on the southern part of Africa, at a distance of about 5000 miles from the scene of the eruption, were from 1 to 2 feet high, the original long waves being of an unknown height, but probably did not exceed 10 or 15 feet. No other such opportunity of testing the distances to which great waves may travel has ever occurred, and as such a catastrophe as gave rise to them could scarcely be repeated without similar loss of life, it may be hoped we shall not live to see another, interesting though the discussion of the numerous phenomena were.

The movement of the particles of water due to the tide wave extends to the bottom of the deepest water, and doubtless plays an important part in keeping up a constant motion in the abysses, but the depth to which the action of the surface waves originating in wind reach is still but little known by observation. If, however, we study the contour of the bottom off the shores of land exposed to the full influence of the great oceans, we are struck by the very general rapid increase of slope after a depth of about 80 to 100 fathoms (500 to 600 feet) has been reached. It appears probable that this is connected with the depth to which wave action may extend, the fine particles brought down by rivers or washed from the land by the attrition of the breakers being distributed and gradually moved down the slope. When we examine banks in the open sea we find, however, that there are a great many with a general depth of from 30 to 40 fathoms, and the question arises whether this may not be the general limit of the power of oceanic waves to cut down the mass acted upon when it is fairly friable.

The question has an interesting bearing on the subject of the ever-debated origin of coral atolls, for this is the general depth of many large lagoons; and granted that the sea can cut down land to this depth, we have at once an approach to the solution of the problem of the formation of bases of a suitable depth and material upon which the coral animal can commence operations. This question also awaits more light, and I merely offer this remark as a suggestion. It is, however, somewhat remarkable that, in recent cases of volcanic islands piled up by submarine eruptions, they have all been more or less rapidly washed away, and are in process of further diminution under the surface.

Observations on the mean level of the sea show that it constantly varies, in some places more than others. This subject has not yet been worked out. In some localities it is plainly due to wind, as in the Red Sea, where the summer level is some 2 feet below that of winter, owing to the fact that in summer the wind blows down the whole length of the sea, and drives the water out. In many places, as in the great estuary of the Rio de la Plata, the level is constantly varying with the direction of the winds, and the fluctuation due to this cause is greatly in excess of the tidal action. In others the cause is not so clear. At Sydney, New South Wales, Mr. Russell found that during eleven years the level was constantly falling at about an inch a year, but by the last accounts received it was again stationary.

The variations in the pressure of the atmosphere play an important part in changes of sea-level. A difference of one inch in the barometer has been shown to be followed by a difference of a foot in the mean level of the sea, and in parts of the

world where the mean height of the barometer varies much with the seasons, and the tidal range is small, this effect is very marked.

Of any secular change in the level of the sea little is known. This can only be measured by comparison with the land, and it is a question which is the more unstable, the land or the water—probably the land, as it has been shown that the mass of the land is so trifling, compared with that of the ocean, that it would take a great deal to alter the general mean level of the latter.

All the points connected with the sea that I have had the honour of bringing before you form part of the daily observation of the marine surveyor when he has the chance, but I cannot refrain from also mentioning other duties, which are indeed, in the present state of our knowledge and of the practical requirements of navigation, the principal points to which he has to pay attention, as it may explain why our knowledge on so many interesting details still remains very imperfect.

Working as we do in the interests of the vast marine of Great Britain, the paramount necessity of good navigational charts requires that the production of such charts should be our principal aim. It is difficult for a landsman, and difficult even for a sailor who has never done such work, to realize the time that is necessary to make a really complete marine survey. The most important part, the ascertainment of the depth, is done, so to speak, in the dark—that is to say, it is by touch, and not by sight, that we have to find the different elevations and depressions of the bottom of the sea. In making a map of the land, an isolated rock or hill stands up like a beacon above the surrounding land, and is at once localized and marked, but a similar object under the sea can only be found by patient and long-continued sounding, and may very easily be missed.

When it is considered that marine surveying has only been seriously undertaken for about 100 years, with a very limited number of vessels, we shall, I think, understand how in the vast area of the waters, taking only those bordering the shores, many unsuspected dangers are yearly discovered. Very, very few coasts have been minutely surveyed, and, setting aside for a moment the great changes that take place off shores where sandbanks prevail, I should be sorry to say that even on our own coasts charts are perfect. Yearly around Great Britain previously unknown rocks come to light, and if this is the case at home, what are we to think of the condition of charts of less-known localities? Our main efforts, therefore, are directed to the improvement of charts for safe navigation, and the time that can be spared to the elucidation of purely scientific problems is limited. Nevertheless, the daily work of the surveyor is so intimately connected with these scientific problems that year by year, slowly but surely, we add to the accumulation of our knowledge of the sea.

MORPHOMETRY OF THE LAKE OF CONSTANCE.*

In 1886 the five shore-states of the Lake of Constance appointed a commission for the construction of a map of the lake, which determined the outline of this, the largest of German lakes, by means of new triangulations, and carried out extensive sounding operations in it. The results of these labours were laid down in a map, on the basis of which a calculation of the volume has been made under the direction of Professor A. Penck, in the Geographical Institute of the Vienna University, under

* Communicated by Dr. K. Peucker, of Vienna.

the auspices of the Ministry of Public Instruction. Besides this, a discussion has been set on foot by Penck himself, the chief aim of which is to test by an example the applicability of a series of morphometric formulæ, which he has brought together in a chaper of vol. i. (shortly to appear) of his 'Morphology of the Earth's surface,' in the series of geographical handbooks edited by Professor Fr. Ratzel.

Since morphometric values possess an importance only when compared with the corresponding ones for other forms of the surface, in the following table the principal values for the Lake of Constance are given side by side with the corresponding ones (likewise in great measure newly ascertained) for other Alpine lakes:—

Lakes.	Area in sq. miles.	Volume in cub. miles.	Mean inclination.	Maximum depth in feet.	Mean depth per cent. of the greatest.	Shore development.	Insulosity.
Constance	206·8	11·5	3°(=5·2%)	827	36	3·46	0·01
Geneva	223·8	21·2	—	1014	50	—	—
Garda	139·5	11·9	5½°	1135	39	1·83	—
Maggiore	81·5	8·9	—	1220	—	3·26	—
Como	—	—	—	1342	38	3·69	—
Lugano	—	—	—	945	—	3·53	—
Zürich	34·2	0·93	—	469	31	—	—
Chiem	31·5	—	—	—	34	2·33	0·03

Lake.	Greatest distance between points on shore— In straight line.	Along centre of lake.	Greatest breadth.	Mean breadth.	Circumference.
Constance	43 miles	46·5 miles	8 miles	4·47 miles	176·5 miles

While taking the second place among Alpine lakes as regards area (it is only 222 square miles even at high water), it occupies only the third in respect of volume—that of the Lake of Geneva, which so little exceeds it in area, being nearly double; while in the same respect it does not come up to the Lake of Garda, of which the surface is so much smaller, being even at high water only 11·84 cubic miles. This at once shows the slight relative depth of the Lake of Constance, in which it is surpassed by five other Alpine lakes. Moreover, the proportion of the average to the maximum depth is very low in the Lake of Constance, being less only in the Lakes of Chiem and Zürich, while in all the other Alpine lakes of which the volume has yet been calculated it is considerably higher. This figure, expressed by Penck by a percentage, is of especial morphological value, inasmuch as it allows a conclusion to be drawn as to the general form of the basin: if the proportion amounts to half, or 50 per cent., the form is paraboloidal, and thus the lake is "cauldron-shaped" ( ); but when it is about 33 per cent., the form is pyramidal or conical, and the lake is "funnel-shaped" ( ). The greater number of the Alpine lakes hitherto investigated—*e.g.* besides the Lake of Geneva given above, that of Brienz (67 per cent.), Annecy, French Alps (65 per cent.), the Mond-see, Salzkammergut (53 per cent.), the Traunsee, Salzkammergut (47 per cent), and others—have cauldron-shaped basins, but the Lake of Constance a funnel-shaped. The relative shallowness of the bed of the Lake of Constance is matched by the gentleness of its slopes (the mean inclination), in which respect it is surpassed not only

by the Lake of Garda, but by all the lakes situated in the Alps, as the following table shows:—

Wolfgangsee	5½°	Walchensee	9°
Traunsee	6½°	Kärntner Weissensee	9½°
Thunersee	7½°	Brienzersee	12°
Walensee	8°	Königssee	20½°
Hallstädtersee...	8½°		

In order to rightly comprehend the flatness of the bed of the Lake of Constance, one must keep in view the fact that its mean inclination, which amounts to 3° only, would hardly be represented at all on a *hachured* map. The type of ground to which the lake belongs is that of a plain; it is thus out of the question that the basin originated in a rifting of the Earth's crust. This shallowness, moreover, is also closely connected, as Penck shows, with the varied outline of the lake, which is borne out, *e.g.*, by the fact that the Lake of Garda, with its regular outline, is decidedly deeper and has a more steeply sloping bed. The expression for the diversity of outline is the figure which gives the number of times greater the circumference of an area is, than the least amount possible (*i.e.* in the case of a circular outline). Judged by this standard, the Lake of Constance does not, it is true, show the greatest "shore development" among the Alpine lakes—this is exceeded by that of the Lakes of Como and Lugano—but it comes far above that of the Lakes of Chiem, Iseo (2·14), and Garda, and is in fact greater than that of Lake Maggiore. The Lake of Constance is poor in islands; its "insulosity," *i.e.* the proportion of the area of islands to that of the water-surface, is, *e.g.*, three times less than that of the Lake of Chiem. Yet, to compare small with great, it is almost equal to that of the Indian Ocean. The "Swabian Sea" is small in this conjunction, but still large in comparison with almost all the other lakes of the region of the Alps. Thus the "Bavarian Sea" (the Lake of Chiem) is six times smaller than it, and one could fill all the lakes of the Eastern Alps together, with the exception of the Upper Italian, twice over with the water of the Lake of Constance. "Such a difference in volume warns us that the causes which have contributed to the formation of the Lake of Constance are in some respects different from those which have led to the origin of its eastern neighbours."

THE GEOGRAPHICAL DISTRIBUTION AND HABITS OF WHALES.*

By PROFESSOR C. MÖBIUS.

WHALES, as air-breathing mammals, are compelled to remain near the surface of the sea. In order to breathe, they must at least raise their nostrils, which are placed at the highest part of the head, above the water. They are drowned if they get into nets, which keep them under water. Redner asserts positively that the whale blows jets of water neither from the lungs nor from the mouth, but that what is taken for such is either condensed water-vapour or the small amount of water resting in or above the nostrils.

The toothed whales (*Denticete*), which are provided with permanent teeth, feed by preference on fish and cuttlefish; the whalebone whales (*Mysticete*), which have only embryonic teeth, on fish, cuttlefish, and swimming or floating organisms which

* Address before the Berlin Geographical Society, June 2, 1894.

are found in swarms (Mysids, Copepods, Salpæ, Pteropods, Diatoms, etc.), and which they strain from the water by means of the whalebone structure. The whales move about in search of the animals on which they feed.

The most serviceable of the whalebone whales belong to the genus *Balæna*, in which the structure is long, and there is no dorsal fin. The best-known species is *Balæna mysticete*, the Greenland whale, which reaches a length of 62 feet and a weight of 160 tons. It lives in the northern circumpolar sea. In the seventeenth and eighteenth centuries it was common in the neighbourhood of Spitzbergen. It has been taken since the end of the eighteenth century in Davis Straits, and since 1847 in the Behring Sea and near Kamchatka. On the west coast of Greenland it descends to only 64° N. lat. It has become so scarce, however, at the present day, that in the most recent times hardly one a year has been taken.

More to the south, in the North Atlantic and North Pacific Oceans, there are found two species of *Balæna*, with shorter whalebone, and one or more prominences over the centre of the upper jaw. *Balæna Biscayensis* reaches a length of 50 to 53 feet. The Basques used to kill it as far back as the eleventh and twelfth centuries with bows and arrows and harpoons. After becoming very rare, it appeared again in 1854 on the coast of Northern Spain. Between 1889 and 1891 sixteen specimens were killed south of Iceland. It is distributed over the area from the west coast of Norway to the Canaries and the east coast of the United States, and passes also into the Mediterranean.

Balæna Japonica is taken in the North Pacific Ocean, from San Francisco as a base, between 30° N. lat. and the Aleutian Isles; and on the Asiatic coast it is found between Saghalien and Formosa. The Japanese have taken it on their coasts for more than two hundred years with nets and harpoons.

Two species of *Balæna* inhabit the southern hemisphere, viz. *Balæna Australis*, on the coasts of Africa between 36° and 48° S. lat. Isolated specimens are also met with at Cape Horn, on the west coast of South America, and near New Zealand.

Balæna marginata is spread over the space from the west coast of South America as far as New Zealand, South and West Australia. To the north it apparently does not pass 30° S. lat. in any numbers.

The finned whales are not so valuable as the Baleen whales. Their head is shorter, the upper jaw lower, the whalebone is shorter and less elastic. They have on the back an upright membranous fin, and are furrowed on the throat, breast, and belly. Since 1865, great numbers have been killed on the north coasts of Europe with explosive charges, dynamite, etc.

Balænoptera musculus, distributed from Greenland to Novaya Sembla, advances southwards as far as the North Sea and the Baltic, and even to the Mediterranean, in its pursuit of shoals of fish.

Balænoptera Sibboldi, reaching a length of 88 feet and a weight of 160 tons, is the largest denizen of the earth. It is taken between Greenland and Novaya Sembla, and between North America, China, and Japan. Specimens have also been met with at Cape Horn and in the North Sea.

Balænoptera borealis, 43 to 50 feet long, is taken from the Lofoden Islands to Finmark. It feeds chiefly on swimming crabs.

Balænoptera rostrata, the Dwarf Whale, 20 to 30 feet long, distributed from Norway to Greenland and Labrador, lives principally on fish (herrings, etc.).

Megaptera boops, Bunched Whale, reaching a length of 72 feet, with very long pectoral and low dorsal fin. Inhabits the Arctic Sea.

Rachianectes glaucus, Grey Whale, up to 40 feet long, with very short whalebone. Lives in the North Pacific Ocean; it wanders in summer as far as Kamchatka, and in winter to the northern tropic.

Among the toothed whales, the most valuable is the Spermaceti Whale, *Physeter macrocephalus*. The female is 33 to 40 feet, the male up to 72 feet long. It has teeth only in the lower jaw. In the head and back are two cavities filled with liquid fat (spermaceti), and in the intestine ambergris is found. It is hunted principally in the warmer parts of the Atlantic, Indian, and Pacific Oceans, but it also reaches the Polar Seas.

Hyperoodon rostratus, 20 to 30 feet long, allied anatomically to the spermaceti whale, has only a few small teeth in the lower jaw, and is spread from Novaya Zemlya to the east coast of North America. It goes as far north as Spitzbergen in summer, and repairs to more southern waters in winter.

With the same distribution as the spermaceti whale, *Globiceps melas* is found between Norway and the Faeroe Islands in herds of sometimes several thousand individuals. On these islands its chase and the apportionment of it between the authorities and the islanders have, since 1854, been regulated by law. About fifty thousand head are killed there yearly.

The Narwhal (*Monodon monoceros*) is spread over the whole Northern Polar Sea. Off Greenland it is often seen in closely packed herds. The huge left tusk of the male is worked up like ivory.

In the whole Northern Polar Sea, the White Whale also (*Delphinapterus leucas*) is found. Its length is from 10 to 23 feet.

Delphinus tursio, 10 to 13 feet long, has in both jaws twenty-one to twenty-five teeth on each side, and occurs in herds of one to two hundred individuals. Its habitat is the North Atlantic Ocean, where it seldom passes northward of 66° N. lat.

Phocæna communis, the porpoise, or sea-hog, 3 to 5 feet long, with twenty-five to twenty-eight teeth on each side, lives on the coasts of North Europe and Greenland, and is also spread over the whole North Atlantic Ocean. It also enters the North Sea and the Baltic, the Mediterranean, and the Black Sea. It leaves the Baltic in November. Between that month and February, about fifteen hundred head are taken yearly in the Little Belt.

The chase of the whale is a violent encroachment of man on the communities of life on the sea, and the interchange of the materials for its support. If it is continued in the present reckless manner, the largest denizens of the earth will soon belong only to the realm of legend.

THE MONTHLY RECORD.

THE SOCIETY.

Educational Lectures. — It has been arranged by the Council that during next session the third course of educational lectures by Mr. H. J. Mackinder will be delivered in connection with the London University Extension. They will be given at Gresham College on successive Mondays, at 6 p.m., beginning on October 8. The course will consist of twenty-five lectures in all, on the History of Geography and Geographical Discovery. Ten lectures will be given before Christmas, when the Ancient and Mediæval period will be treated; ten between Christmas and Easter, when the Rennaissance and Modern period will be dealt with; and five lectures after Easter, when certain selected books (*e.g.* 'Marco Polo') will be referred to. To these lectures Fellows of the Society will be admitted free.

Society's Prizes to the Cadets of the Training-Ships "Worcester" and "Conway."—The Royal Geographical Society's prizes for proficiency in geography in the late examinations in these training-ships have been awarded as follows:—"Worcester:" Algernon Percy Le Clerc Faught, 1st prize; Joseph Leonard Hall, 2nd prize; Richard Frederick Hayward, Mr. Clements R. Markham's prize. "Conway:" Herbert Raymond Bateman, 1st prize; Thomas Samuel Beauchamp Williams, 2nd prize; George Edward Barton, Mr. Clements R. Markham's prize.

EUROPE.

The Glaciation of the Riesen-Gebirge during the Ice-Age.—The Riesen-Gebirge, the highest extra-Alpine range of Central Europe (Schneekoppe, 5266 feet), lying on the Austro-Prussian frontier, although at the present day far below the climatic snow-limit, was, according to the researches of J. Partsch (*Forschungen zur deutschen Landes u. Volkskunde*, vol. viii. part 2), covered in its higher parts with perpetual snow and glaciers at the time when the inland ice, streaming down from the Scandinavian mountains, reached as far as Scotland, and far over the North-German plain. Unmistakable traces of the same are present in the moraines as well as in the material deposited by the glacier-streams. These traces, considered in connection with the relief of the range, permit the conclusion that the range at that epoch possessed two clearly separated glacier-regions, and, beyond this, point distinctly to two successive periods of glaciation. During the first, the height of the snow-line (determined from the limit-values of the heights of mountains on which glaciers first begin to appear, and of those which have remained free from glaciation) was about 3770 feet, and the two glacier-regions together occupied an area of 32 square miles, of which seventy-two per cent. belonged to the southern (now the Bohemian) portion of the range. From the western field of névé (that from which the Elbe at the present day derives its origin) five glaciers, varying from 1860 to 3280 yards in length, descended, and from the eastern (by far the larger) nine glaciers, of about 2950 to 5800 yards. The extreme tongues of these fourteen ice-streams were placed at an average height of 2950 feet. After this first great ice-period, a decided retreat of the glaciers, and a long epoch marked by a small extent of ice, must have supervened. For not only did the glacier-streams find time in it to chisel out a terrace-system within the materials deposited by themselves, but there was also time enough for a ridge of rock, which so completely separated two neighbouring *Kahren*, that in the first ice-period an entirely independent elongated glacier was derived from each, to be so far worn down, that at the time of the second glaciation the glaciers united in a single short tongue common to both. Of this second ice-period, ten glaciers have left behind moraines which have remained fresher and been preserved in a better-defined form, and at a mean elevation of 490 feet higher, than those of the great ice-period. These were mostly small *Kahr* glaciers, and with them were but a few of the present "Alpine" type, whilst the glacial phenomena of the first period belonged to the so-called "Norwegian" type of the present day. The height of the climatic snow-line must have been about 4430 feet in the second period. An important light is thrown on the climatic conditions of both periods by the fact that the southern aspect shows no traces of any influence unfavourable to the development of glaciers.

The Rhone-Marseilles Canal.—The Rhone and its tributary the Saône form a magnificent natural waterway, connected by a network of canals with all the great rivers of Central and Eastern France, as well as with the Rhine. The shallowness of certain parts of the Rhone has always impeded the passage of boats

of considerable draught, but this obstacle has been practically removed by the great engineering works now nearly completed, which ensure an average depth of 5 feet 4 inches during almost all the year. The delta, however, has hitherto presented peculiar difficulties owing to the constant silting up of the mouth. Various attempts have been made to obviate this by extensive dyking and by subsidiary canals, parallel to the course of the river, but having a different outlet. The last great work was intended to be final. Between 1865 and 1870 nearly a million sterling was spent in forming the port of St. Louis du Rhone, near the mouth of the river, and connecting it by a canal with the Gulf of Fos. The anticipations that St. Louis would rival Marseilles were frustrated by malaria and the silting up of the Gulf of Fos. Another cause necessitated direct communication between the Rhone and Marseilles. The tunnelling of the Alps diverted much traffic from Marseilles to Venice, and especially to Genoa. Genoa now rivals Marseilles, its traffic having increased 100 per cent. in the last decade, or five times as much as that of Marseilles. In the *Revue de Géographie*, July, 1894, M. Charles-Roux discusses the proposed new canal with elaborate statistics and many excellent maps. The terminal basin is at the north end of the Marseilles docks. After skirting the shore for some miles, the canal is carried under the Chaîne de l'Estague to the Etang de Berre, whose shore it follows to Martigues. Thence it goes to the Port de Bouc, and follows the course of the Arles canal to the Etang de Oatéjon, from whence it proceeds in a straight line to the Rhone. The length is 34 miles, of which about 4½ are tunnelled underground. The average depth is 10 feet between Marseilles and Port de Bouc, and 6½ feet the rest of the way. The total cost is estimated at £3,200,000. The author shows the importance of the Etang de Berre as a harbour of refuge were Marseilles besieged. This lagoon is a true rock-surrounded gulf, capable of being easily made 30 feet deep by dredging. The formation of a canal to the sea which would float the largest vessels is the most formidable obstacle to the utilization of this magnificent and impregnable natural harbour.

ASIA.

The Identification of Marco Polo's Zipangu.*—We have received from Mr. F. G. Kramp, map curator of the Royal Dutch Geographical Society, the reprint (in English) of an article contributed by him to the Journal of that Society, in which he combats the novel propositions brought forward by Mr. G. Collingridge in the May number of this *Journal*, and ably sets forth the reasons, which should make us decline to give up the orthodox view. Mr. Collingridge, it will be remembered, tried to show that the Zipangu of Marco Polo and the early cartographers was in reality not Japan, as has been believed by all writers of repute since that country was first reached by the Portuguese, but Java. While admitting that the method of inquiry laid down by Mr. Collingridge, "though not new, is irreproachable in itself," the writer holds that a minute examination of his article results in showing "that though the author has gathered several items with great boldness and a skill which cannot be denied, yet most of his arguments are totally at variance with historical truth." Mr. Kramp's main points are as follows: The early European maps, dating from before the arrival of the Portuguese in the Eastern Archipelago (*i.e.* about 1509), were not based on surveys, but only roughly represent the reports of travellers, Ptolemy being their basis, and the remainder almost entirely borrowed from Marco Polo, with minor additions from Oderic, etc., Marino Sanuto's map of 1320 being the only one in which Arab influence is to be traced. Lelewel, Richthofen, Yule, and Wharton all agree as to the slight accuracy of Fra Mauro's

* See also Mr. Yule Oldham's letter, p. 276

delineation of Eastern Asia (1459), so that Mr. Collingridge's statement that "Java, Bali, Lomboc, and Sumbawa, as represented on his Mappamundi, must have been drawn from a portolano," shows his ignorance of the state of cartography of those days, especially as the last three were not heard of in Europe till the sixteenth century, being precisely the last of the Dutch possessions to be discovered. Mr. Collingridge also fails to notice that, so far from connecting Marco Polo's Zipangu with Java, Fra Mauro really also delineates Japan under the name Zimpagu, though from the exigencies of space the two islands are placed in juxtaposition. On the contrary, at the end of his article, while acknowledging that an island Zimpagu is given, he uses the fact to support his own contention, by supposing that, while given to Bali, the name really represents Sumbawa! Again, Mr. Collingridge states that Marco Polo gives the same distance from China (1500 miles) in the case of both Zipangu and Java, supposing from this that the former refers to the Eastern Archipelago; whereas, if we refer to Polo's account, we find that the distance in the first case is reckoned from Central China eastwards, and in the second from Cochin-China (Chamba, *i.e.* Chiampa) southwards, a very important difference. Then as to the greater applicability of Polo's account to Java than Japan—(1) Oderic's description of the palace in Java is not so like Polo's if we follow Cordier's edition of the former (1891); (2) Polo's account is only from hearsay, and both islands have always had a reputation for riches, while, in fact, Japan does produce more gold and silver than Java; (3) the passage about the burning of the dead (how is this applicable to the *Mohammedan* Javanese at the present day?) is found only in the Ramusian version, and is bracketed by Yule; (4) so far from there being the uncertainty as to Kublai Khan's expeditions which Mr. Collingridge would lead one to suppose, an acquaintance with Eastern authorities tells us precisely that two expeditions took place against Japan, in 1274 and 1281 (the latter being the date assigned by Polo), and one against Java, in 1293, when Polo was already on his voyage home. Polo's account agrees well on the whole with what we know from other sources of the expedition of 1281 against Japan. Lastly, as to the idols in Zipangu, and the addiction of the people to the eating of human flesh—in Yule's and Panthier's text the name Zipangu is not mentioned a single time in this reference. Buddhist idols, moreover, would have then been found in Japan as in Java, while Polo himself qualifies the statement as to cannibalism, by saying "that he never was there." The "Sea of Chin" is indeed the southern Chinese sea, but it is only Mr. Collingridge, and not Polo, who states that it is "between Zipangu and China."

Trade in Persia.—The Foreign Office publishes a report on last year's trade in Khurasan. Wheat is smuggled into Russia in enormous quantities, with disastrous results to Persia, which, owing to scarcity of water, produces even in exceptional years only enough wheat for home consumption. The ignorant peasant, needing ready money at the end of the inclement winter, pledges part of next year's crop to Russian speculators at rates so low that Persian wheat is sold in Europe cheaper than wheat grown in Russia. The result is semi-starvation for three-quarters of the population. The Russian customs system is about to be extended from Samarkand into Bokhara, and there is an effort being made to develop Russian trade with Persia. The new tariff will not materially affect British trade, as in the interests of Russian consumers the duties on tea, indigo, muslin, etc., cannot be much increased.

AFRICA.

The Geography of South-West Africa.—Dr. Karl Dove is giving the preliminary results of his investigations into the geography of Damaraland during a

stay of eighteen months in that country, in a series of articles in *Petermanns Mitteilungen*. The first two which have appeared (1894, Nos. 3 and 5) deal respectively with the vertical relief of the country and its climate. With regard to the former, Dove corrects the current idea that the whole country may be described as a plateau-land. The southern part of Damaraland (between 21° and 23° S. lat.), to which his remarks specially apply, has as its foundation a vast mass of elevated country rising gradually from the coast to 17° E. long.; but the surface is varied by real mountain-ridges of considerable relative height, usually of great length in proportion to their breadth. Besides these and individual small plateaux of no great extent, the surface is formed of gentle undulations, which, in their most typical form, reach a height of 300 to 500 feet. Southern Damaraland may be divided into four natural regions succeeding each other from west to east. First comes the coast strip of flat land gradually rising towards the interior, mostly desert, except the river-beds, which are often deeply cut below the general level. The eastern limit is little defined except by the gradual change in climate and vegetation. The second region is one of steppes occupying the western slope of the central mass. The general rise of level is most pronounced of all here, the rivers showing a steep fall. Their deeply eroded valleys do not necessarily prove a former greater precipitation, but may be in great measure due to the extraordinary range of temperature between night and day. The mountain-land which forms the third region is of two types: (1) the region of the Otjiseva river, in which the ridges run principally from north to south, compressing the river-basin into a narrow compass; they are the highest and steepest in the neighbourhood of the main valleys, and form a great barrier to communication except in the direction of the latter; (2) the source region of the Kuiseb, the Khomas-land, an elevated tract with undulations of varying width. The fourth main region is that of the basin of the Nosob, beginning from the water-parting east of Windhoek, and becoming more and more level towards the east. It is traversed by the Elephant river, which flows to the Nosob, and has a fairly copious water-supply, the district being apparently the most rainy of German South-West Africa. The land of the Rehoboth Bastards, which may be regarded as a fifth natural region, has many points of resemblance with the eastern parts of Damara-land. As regards the climate, the three most striking characteristics of the whole region are, the uniform daily range of temperature throughout the year, the great difference in temperature between day and night, and the extreme dryness of the air everywhere in the interior. On the coast the uniformity throughout the year is extraordinary, southerly winds, with dense mist due to the cold coast water, being almost constant. There is hardly any actual rain. In the transition region between the coast and the interior, the mists are sooner dissipated after sunrise, and the day temperatures higher, the difference between those of the day and night increasing with the distance from the coast. Precipitation is very slight, and mostly in the form of thunder-showers. The dryness of the air makes the heat supportable. The whole interior of Southern Damaraland may be classed together with respect to climate, although, of course, minor differences occur. The heat of summer and the cold of winter are moderate throughout. Even in the hottest months (November and December) the evenings are pleasantly cool. In the mountains the winter frosts are not severe, except in the lower parts of shut-in valleys, to which the cooled air sinks. The amount of the rainfall, too, is more favourable than has been supposed, varying from 8 to 12 inches in the exterior parts, and reaching 20 inches, and perhaps more, in the central mountains. The rains begin in October, but cease more or less completely in November and December, the regular rainy season beginning at the end of the latter month, with downpours of thunder-rain, mostly after 2 p.m., which bring about a sharp fall of

temperature. From its concentration into a third of the year, the effect of the rain is more favourable to vegetation than if the same amount were evenly distributed. The idea that there are rainless seasons in the interior is, Dr. Dove thinks, mistaken.

German Scientific Work on Mount Kilimanjaro.—During the past eighteen months considerable progress has been made by the Germans in the scientific study of the slopes of Kilimanjaro (*Mitt. aus d. Deutschen Schutzgeb*, 1894, part 1). A station has been founded in the district of Marangu, in the south-east, at an elevation of 5118 feet, to serve as a base of operations, by Drs. Lent and Volkens, the former of whom has devoted his attention to the topography, geology, and meteorology of the district, and the latter to the botany, especially from an economic point of view. The station having been got into working order, and the war with Mosbi and Kilema being concluded, excursions were made into the more elevated parts, a hut being built at a height of 9180 feet. Dr. Volkens also accompanied an expedition into the Vgueno mountains, where he found the cultivated plants of the Chagga states growing side by side with those of the coast, and where he thinks the prospects of tropical cultivation much better than on Kilimanjaro. In his opinion the ideas current as to the value of the forest zone on the latter are much exaggerated. In order to obtain a map sufficiently detailed to serve for his scientific investigations, Dr. Lent has carried out an extensive triangulation, the results of which he has laid down on the large scale of 1 : 25,000. The broad features only of the geology were at first studied, an important point kept in view being the distinction (as affecting the value for cultivation) between soils composed of lavas and tuffs. The plan laid down for the meteorological observations is comprehensive, and should yield valuable results. From a recent number of the *Deutsches Kolonialblatt* (June 1, 1894), we learn that in March last a full year's record was all but completed. Good progress had been made with the topographical surveys, and the botanical collections contained over two thousand species. In December last, while on the road to the military station at Moshi (*id.* June 15), Dr. Volkens inspected the agricultural experiments at the Catholic Mission Station at Kilema, which helped him to form an idea of the prospects of European enterprise in this direction, with reference particularly to the zone between 4260 and 5570 feet, which is, with slight exceptions, the only part hitherto inhabited. At present no paying vegetable product exists. The year is divided sharply into wet and dry periods, with a considerable difference of temperature, in the former of which the intensity of the sun's rays is much diminished by thick clouds, therefore the cultivation of specifically tropical or of subtropical plants requiring much light is precluded. A certain number of possible products remain, some suitable for the support of European colonists, and some which might provide exports. The former, Dr. Volkens thinks, would be assured with a proper choice of the season for sowing and suitable irrigation during the dry season. Below the zone above referred to, a steppe-vegetation of acacias, euphorbias, etc., prevails for the most part, and conditions are nowhere favourable for tropical cultivation.

Count v. Götzen's Expedition in East Africa.—This expedition, the destination of which is Ruanda, had in February last reached the district of Mangati, situated south of Lake Manyara, in the great East African line of depression (*Pet. Mitt.*, 1894, p. 143). The total following of the caravan numbered 600, and so far the route taken differed little from that of Baumann. The two Indian elephants had been left behind from the want of competent persons to look after them. The forward journey was to lead through Usukuma and cut the Tabora-Victoria Nyanza route at right angles. Count v. Götzen had ascended Mount Gurui, as had previously been done by the naturalist Neumann, reaching a point on the summit-ridge only about 330 feet below the top, which, from aneroid and

boiling-point thermometer observations taken at the beginning of the ridge, must be about 10,500 feet above the sea. Below the ridge a belt of forest, from one to nearly four miles wide, was crossed, above which the vegetation consists of coarse grass, with Alpine violets, forget-me-nots, and rhododendrons. Tracks of elephant and rhinoceros were seen as far as the highest point reached, whither they retire before the attacks of the elephant-hunters. A large lake was observed in the south-west, which does not appear to have been seen by previous travellers. It was called the Lake of Umburre by one of the party, and was said never to dry up. The traces of volcanic action which have been noticed elsewhere in the neighbourhood of the line of depression, are seen here in the form of craters, which occur around, but apparently not upon, the central mountain. A violent shock of earthquake was also felt in the hilly country of Uassi.

Ascent of Tenerife by Dr. Hans Meyer.—The May number of the *Verhandlungen der Gesellschaft für Erdkunde* contains an extract from a letter from Dr. Hans Meyer, giving some details of a recent visit to Tenerife. On March 11, Dr. Meyer met with fresh snow on the Pico del Pozo in Grand Canary, and four days later he observed at Orotava that snow extended far down on the Cumbre. After exploring the Cañadas—the great plateau (6500 feet) from which the cone of the peak springs—Dr. Meyer ascended the Alto de Chaharra (9900 feet), and crossed the recent volcanic beds between Bilma and Icod. A few days were then spent on Teno and Anaga, and on April 5 the ascent of the peak was begun. Dr. Meyer's was the first ascent of the season, and the success of the undertaking seemed uncertain, as the deep snow had received a fresh covering from thunder-showers a few days before. Snow was first encountered at a height of 6000 feet, but mules were not finally dispensed with till 8200 feet had been reached. The hut at Alta Vista (10,700 feet) was entirely buried in snow, and an entrance to it had to be dug out. Temperature fell to 21° Fahr. during the night; and on the summit being reached at eight next morning, after some stiff climbing on snow and rock, a reading of 27·5° Fahr. was recorded. The wind at the summit blew strongly from north-east—obviously not the antitrade—and the peak itself, owing to its internal heat, was practically clear of snow. The atmosphere was fairly clear, and a good bird's-eye view of the Cañadas was obtained. Descending to Orotava, Dr. Meyer crossed the Pedro Gil Cumbre to Guimar, in order to reach the coast at Santa Cruz. About one hundred and fifty large photographs have been obtained, and numerous measurements of the limits of snow and of vegetation.

Arrangement between France and the Congo Free State.—On August 14, an arrangement was agreed to between France and King Leopold, as sovereign of the Congo Free State, which considerably modifies that referred to in the *Journal* for July, p. 54. A glance at the map on p. 55 will enable the reader to understand what has been done. King Leopold has, in brief, agreed not to occupy the territory leased to him by Great Britain further to the north than 5° 30′ N. lat. In consideration of this, France has agreed to an extension of the northern boundary of the Congo Free State. From the junction of the Mbomu with the Ubangi, the northern boundary follows the *thalweg* of the former river to its source, and thence the water-parting between the basins of the Congo and the Nile to the eastern limit of the State, 30′ E. long. The fact may also be recorded that, in deference to the protest of Germany, England has renounced the lease of the strip of territory within the Congo Free State between Lakes Tanganyika and Albert Edward.

AMERICA.

The Formation of the Bermudas.—The June number of the *American Journal of Science* publishes some notes on the Bermudas from a letter to Professor

J. D. Dana, by Dr. A. Agassiz. Dr. Agassiz spent about a month in examining the Bermudas with the view of completing previous work in the Bahamas, and finds that their story is practically an epitome of the physical changes undergone by the larger group. The relative absence of reef-building corals is, however, a distinctive feature. Dr. Agassiz takes a different view from previous investigators, as to the part which the corals now growing have played in the formation of the reef-ledge flats. He finds that the corals have not added any material part to the reefs; they form only a thin veneer over the disintegrated ledges of æolian rocks, which constitute the so-called reef off the south shore of Bermuda, and the ledge flats of the outer reef-ring near the edge of the Bermuda bank. Æolian rock-ledges underlie the growth of corals, not only on the patches off the south shore and on the ledge flats of the outer reef, but they also underlie the so-called patches and heads forming the flats which extend on both sides of the main channel, and divide the interior waters of the bank into irregular sounds, like Murray anchorage. The passage of the shore æolian rock ledges into the coral patches can easily be traced both off the north and south shores. The islands are formed by the subsidence of an elliptical mass of æolian rock, derived from a recent coral limestone deposit, probably of great extent and some 330 feet in thickness; and the fantastic outlines of the limestone ledges and of the shore rocks below low-water mark are due to the solvent and mechanical action of the sea, modified by the covering coat of gorgonians, millepores, algæ, and corallines, as well as of the more massive corals. In support of his view, Dr. Agassiz discusses in detail the formation of the serpulæ reefs, and adduces evidence to show that all the structures, from a circular or elliptical atoll to a barrier or fringing reef with all their possible modifications, are due to the action of the surf and the wash of the sea in eating away the surface of the mushroom-shaped rocks, which is either softer than the surrounding parts, or is not protected by the covering of ælgæ, corallines, or serpulæ.

POLAR REGIONS.

The Jackson-Harmsworth Arctic Expedition.—The *Windward*, with the Jackson-Harmsworth Expedition on board, left Arkhangel early in August for Franz Josef Land, after having taken on board ponies, wooden houses, and further additions to its already fairly complete equipment. At the Oxford meeting of the British Association, a paper by Mr. A. Montefiore was read, giving a detailed list of the scientific instruments with which the expedition has been supplied. It is evident that every care has been taken to provide for accurate observation in all departments of science, and advantage has been taken of the most recent improvements in the construction of instruments. Many of them have been made of aluminium for the sake of lightness. In the letter from Mr. Markham to Mr. Jackson, which was printed in the *Geographical Journal* for August, p. 177, the penultimate sentence ought to read as follows: "In your hands, for the time, is the Arctic fame of your country, and I feel sure you will rise to the high level of your undertaking," etc.

The Wellman Polar Expedition.—We learn with regret that the progress of the Wellman Expedition has experienced a somewhat severe check. The *Malygen*, a fishing-vessel, arrived at Tromsoe on August 2 with four members of the expedition on board—Captain Bottolfsen and three sailors—who reported that the *Ragnvald Jarl* reached Table Island on May 12, but was compelled by ice to return to Walden Island, in lat. 80° 37′ N., long. 19° 57′ E., which was reached a fortnight later. On May 24 Mr. Wellman started from Walden Island with thirteen men, forty dogs, and provisions for one hundred and ten days, hoping to reach Northern Spitsbergen early in September, and the head-quarters on Dane's

Island in the beginning of October. Up to that time the conditions had been extremely favourable, the health of the party had been excellent, and the weather continuously fine. Four days after Mr. Wellman left the ship was crushed by ice, and only some stores were saved. A message reporting the wreck overtook Mr. Wellman at Martin's Island, and he, with Mr. Dodge and two other members of the party, returned to Walden Island. A house was built with the wreckage of the ship, in which the greater part of the crew was accommodated, and on May 31 Mr. Wellman started to rejoin his party, and, according to news brought to Walden Island by Mr. Winship and a companion, the expedition was temporarily stopped by impassable ice on June 17, six miles to the east of Platen Island. On the return of Mr. Winship, Captain Bottolfsen and four men started southwards across the ice, taking the aluminium boats, and, after a journey of 230 miles, was picked up by the *Malygen* at Rodeleorg on July 24. On August 10, the United States Consular Agent at Tromsoe despatched Captain Bottolfsen in the *Malygen* to Spitzbergen, with a supply of provisions and clothing for the expedition, for which the *Malygen* was to search. Five days after the *Malygen* left, on August 15, Mr. Wellman and the remaining members of his expedition arrived at Tromsoe, all well, in the whaleboat *Berentine*. From the details which have come to hand, it would seem that on May 12, when the expedition had reached a point within a few miles of the 81st parallel, they were obliged to turn east, their further passage north being blocked by ice. Nearly the whole of North-east Land is stated to have been explored, and a number of interesting observations made. The expedition suffered great hardships while crossing Dove Bay, but eventually reached Walden Island, and some distance further south were taken on board by a fishing-vessel, which brought them to Tromsoe. Mr. Wellman intends, it is stated, to lead a second expedition by the Spitzbergen route next summer.

GENERAL.

Death of M. Dutreuil de Rhins.—We regret to learn of the murder in Tibet of M. Dutreuil de Rhins, the well-known French explorer. He had been travelling in Central Asia for about three years. M. Dutreuil de Rhins had in previous years travelled considerably in Africa and in the East, and was an observant explorer and competent geographer.

CORRESPONDENCE.

*The Early Cartography of Japan.**

It is now nearly six hundred years since the great Venetian traveller Marco Polo startled an incredulous Europe with wondrous tales heard on his travels, of a rich island called Chipangu, lying far out from Asia in the high seas towards the east.

The highest authority on Marco Polo—it should be unnecessary to name the classic work of the late Colonel Sir Henry Yule—accepts Polo's Chipangu as representing the Chinese Jíp-păn-kwć, the kingdom of Japan, and shows that Polo's description consists of actual facts or accepted legends concerning that island.

But, according to an article, entitled "The Early Cartography of Japan," in the May number of this Journal, our accepted ideas are erroneous. "*Marco Polo*," says the author of this article, "*writing from hearsay, describes, in my opinion, Java, and perhaps other islands contiguous to Java, under the name of Zipangu.*" The famous Fra Mauro is credited with the same interpretation of Marco Polo's intentions, in that he places next to "Giava" an island named "Zimpagu;" but

* See note on p. 270.

then comes Toscanelli to spoil this harmonious plan by "stealing" the name "from the proper Java, to apply it to a large island south of the equator," while the name Cipango is clapped on to the island thus robbed of its real name.

"It would be difficult," says the writer, "to find out the exact reason that urged Toscanelli to convert Fra Mauro's Giava into Cipango." It might be difficult indeed, if it had ever occurred.

Apparently Mr. Collingridge, the author of the article in question, has allowed himself to be misled by a superficial similarity between certain maps, coupled with a misunderstanding of Marco Polo, and has placed his convictions before the readers of the *Geographical Journal* in so plausible a fashion that silence is impossible, lest error should spread.

Mr. Collingridge's method of investigation, as laid down by himself, is unimpeachable. "I searched," he says, "on old maps for the origin of the charting of Cipango, and I read up Marco Polo's descriptions carefully." For the first part of his investigation Mr. Collingridge justly considered Fra Mauro's map, completed in A.D. 1459, and Behaim's globe of A.D. 1492, as important documents. The former is at Venice, the latter at Nuremberg; but fortunately there are several reproductions of each in existence. For instance, among the best reproductions of Fra Mauro there is a large and on the whole faithful copy in the British Museum, there is a representation in a series of sections in Santarem's great atlas, and there are photographs, which unfortunately are in parts almost too dark to be legible, but from which a careful reproduction by Professor H. Kiepert has been made, giving those names which are distinctly legible.

Similarly of Behaim's globe there are many copies in the various great atlases of early maps, but notably in such special works as those by Doppelmayr and Ghillany, which deal with the designer of that famous globe.

There is a third document which would be valuable if we had it, namely, Toscanelli's celebrated map, but that unfortunately is lost. Some details given in a letter by Toscanelli have, however, led geographers to conjecture that it must have partly formed the basis of Behaim's globe. Mr. Collingridge goes a step further in saying "we *know* it to be similar" to that globe, and this statement makes it the more surprising that, for the purpose of comparison in the sketch on p. 405, Behaim's authentic globe is not used, but an attempted restoration of the lost map of Toscanelli.

I do not know how far Mr. Collingridge desires to assume responsibility for this sketch by signing his name to it, but it is certainly a rough reproduction of an attempted restoration of the lost map, which was originally published some years ago in "Ausland," and has been copied with tedious iteration into almost every book or atlas dealing with the period of Columbus.

It is unnecessary here to enter into a discussion of the remarkable projection employed. I need only say that it bears internal evidence, to which Professor Wagner of Göttingen first drew my attention—for instance, the extraordinary hammer-headed peninsula at the eastern extremity of Asia, which is not to be found on Behaim's globe—of having been apparently constructed from the very indifferent sketch of that globe given in Lelewel's atlas.

When placed, as on p. 405, side by side with a greatly reduced sketch of a portion of Fra Mauro's map, an apparent resemblance is produced, which at first sight is distinctly misleading. A closer examination, however, will show that in reality this resemblance is purely superficial.

In this connexion it is, I hope, not carping criticism to protest against a certain additional similarity between the two sketches which is produced by the insertion on each of a few names, like India, Mangi, Ciampa and Zaiton, in similar types and

at similar angles, which are not thus to be found on the originals—though, indeed, no great knowledge is required to perceive that neither Fra Mauro nor Toscanelli would have committed the error of inserting the name of Zaiton, the port, as if it were that of a province.

But I feel sure Mr. Collingridge would admit that no scientific purpose can be served by using *a rough sketch of a hypothetical restoration of a lost map reconstructed from an indifferent drawing of a globe*, when that globe exists and is accessible; and yet this is what has been done on p. 405. It is like quoting an author by an abridged version of a translation made from an indifferent text.

Even if the better drawing of Fra Mauro's Giava on p. 407 be compared with the "Cipango" in this Toscanelli sketch, the resemblance will be seen to be slight; but if the comparison be made with one of the careful reproductions of the original Behaim's globe, to which I have referred, the similarity will be found to be still slighter.

In fact, Behaim's Cipango, far from being "almost a tracing of Fra Mauro's Giava," resemble it only in so far as that they are both somewhat rectangular, longer than broad, and placed vertically—characteristics common to other doubtful islands in fifteenth-century maps, *e.g.* Antillia, Saluaga.

With regard to the sketch on p. 407, which seems to be taken from Santarem's atlas, though it is rather startling to find in the heart of it, at the end of a long inscription beginning "Giava mazor isola noblissima," the words "Geo. Collingridge del. 93," there is certainly a superficial resemblance to Java and some of its adjacent islands; but this again is misleading, and, it must be said, much less marked in Kiepert's reproduction of Fra Mauro. It is really only due to the fact that there is a short string of small islands to the east of Java, while Fra Mauro shows Java as a large island in the middle of a string of smaller ones stretching halfway round the world. Mr. Collingridge's statement that Fra Mauro "must have drawn these East Indian islands from a portolano, for they bear, especially Java, the characteristic correct features of those documents," rests on no other basis than his own assertion. It would indeed be remarkable if Fra Mauro had had accurate information of these few islands, when it is only too evident that his knowledge of their situation and surroundings, as, in fact, of nearly the whole of Asia, both continental and insular, was of the very vaguest description. Mr. Collingridge adopted a second line of investigation—"I read up Marco Polo's descriptions carefully," he says.

It is difficult to believe that any one could nowadays set himself to write seriously about Marco Polo without consulting Colonel Yule's edition, but had Mr. Collingridge done so, it is improbable that he would have made such statements as that "the descriptions of the extraordinary richness of the sovereign's palace," etc., "have always referred to Java," or that "the great Khan Kublai may have sent military expeditions to Japan; we know for certain that he sent several to Java;" for in the edition referred to, authorities are quoted to show that the former agree with Chinese traditions about Japan, and as regards the latter point, the dates are given of more than half a dozen expeditions sent by Kublai against Japan between A.D. 1266 and A.D. 1281, together with a long extract from the Japanese Annals translated by Titsing, referring to a Mongol expedition, which agrees with that described by Marco Polo, even down to the names of the generals in command.

It is, however, not merely Marco Polo's editor, but that grave writer himself, who fails to receive the careful consideration which is his due. According to Mr. Collingridge, "Marco Polo says that the island of Zipangu is 1500 miles from China," and "gives precisely the same distance to Java." What Marco Polo actually says is, "You must know that on leaving the port of Zayton you sail west-south-west 1500

miles, and then you come to a country called Chamba" (Cochin China); and in the following chapter, "when you sail from Chamba 1500 miles in a course between south and south-east, you come to a great island called Java," which altogether gives the position of Java as 3000 miles in a southerly direction from the port of Zayton, in China, while "Chipangu is an island towards the east in the high seas 1500 miles distant from the continent." Mr. Collingridge seems to have skipped a chapter in his reading of Marco Polo.

It is, however, a description of the monsoon navigation which he finds "conclusive." It is only necessary to point out that this description occurs after Marco Polo has finished with Chipangu, exclaiming, "But now we will have done with that island, and speak of something else."

These inaccuracies with regard to Marco Polo are so obvious that reference to Mr. Collingridge's article would have been needless had he not appealed to cartography, and illustrated his paper by sketches which are likely to mislead.

There is a double danger with regard to early maps, which demands great discretion in their use. Comparative cartography is a most valuable adjunct to the scientific investigator, but in unskilled hands is like a keen-edged tool, not only dangerous to the user, but apt to suffer injury itself.

Mr. Collingridge's concluding paragraph contains an essay in etymology which can scarcely be meant to be taken seriously. Without dwelling on the decided improbability, from known facts, of Sumbawa ever having been heard of until more than fifty years after Fra Mauro's time, or on the question of the correct reading of the name on Fra Mauro's map ("Zimpagu" is not that adopted by Kiepert, but Zimpangu), one can only express profound astonishment at the effort to identify Cipango with Sumbawa by the method of a "more homogeneous choice"! It was to have been hoped that this "method" had long since perished of well-deserved ridicule.

H. Yule Oldham.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. R. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

EUROPE.

Austria—Vienna. *M.G. Ges. Wien* **37** (1894): 384–405. **Umlauft.**

Die Wiener-Neustädter Canal. Von Professor Dr. Friedrich Umlauft.

This canal will be referred to in the Monthly Record. It forms the first part of a projected line of canal-communication between Vienna and the Adriatic.

Continental Handbook. **Tiedeman.**

The Continent by Queenboro' viâ Flushing a comprehensive and unconventional Handbook for English and American tourists abroad. By H. Tiedeman. *With seven Maps and numerous Illustrations.* London, Iliffe & Son, 1894. Size 7½ × 5, pp. xvi., xliv., and 566. *Price* 3*s. net. Presented by the Publishers.*

Contains brief descriptions of a number of places of interest on the Continent, with a few preliminary hints for tourists.

England—Oxfordshire. **Murray.**

Handbook for Travellers in Oxfordshire. *With Maps and Plans.* London, John Murray, 1894. Size 7 × 5, pp. vi. [14] and 242. *Price* 6*s.*

It should be noted that the Handbook for Oxfordshire now occupies a volume by itself. The present edition has been carefully revised, and contains a good map of the county with the main roads coloured, and also a clearly executed plan, in two sections, of the city of Oxford.

France—Rhone. *B.S.G. Paris* **15** (1894): 70–134. **Bourdon.**

Le Cañon du Rhone et le lac de Genève. Par G. Bourdon.

Germany—Riesengebirge. **Partsch.**

Die Vergletscherung des Riesengebirges zur Eiszeit. Nach eigenen Untersuchungen dargestellt von Dr. Joseph Partsch (Kirchoff's Forschungen zur deutschen Landes- und Volks-kunde. Achter Band. Heft 2). Stuttgart, J. Engelhorn, 1894. Size 9½ × 6½, pp. 98. *Price* 6 *marks.*

This memoir is illustrated by maps, sections, and a series of photographic views.

Great Britain. **Ramsay.**

The Physical Geology and Geography of Great Britain: a Manual of British Geology. By the late Sir Andrew C. Ramsay. Sixth Edition. Edited by Horace B. Woodward. London, Edward Stanford, 1894. Size 8½ × 6, pp. xv. and 421. *Maps and Illustrations. Price* 10*s.* 6*d. Presented by the Publisher.*

We are glad to welcome this classic of physical geography in its new form, which should give it a fresh lease of life and usefulness. The revision and extension of the original has been done wisely and sympathetically, although in some cases less completely than might be advisable. This is particularly the case in the section on the origin of lakes, which might well have been supplemented by a note referring to recent advances both in observation and theory. The geological map is utterly inadequate, and a selection of reproductions of photographs of typical scenery would enormously increase the value of the book.

Holland—Dunes. **Lorié.**

Tijdschr. Nederlandsch Aardrijksk. Genoots. **10** (1893): 753–796, 939–980.
Binnenduinen en Bodembewegingen, door Dr. J. Lorié.

A description of the sand-dunes along the coast of Holland given in great detail, the different sections of the coast being separately treated, and the general character of the whole subsequently generalized. A map of the dune-covered districts is given, and a series of diagrams.

Iceland. *Quarterly R.* **179** (1894): 58–82. ———

Iceland To-day.

Italy—Appenines. *Rev. G. Italiana* **1** (1894): 429–438. **Roggero.**

Il collo di "Bocca Trabaria" come limite tra l'Appennino Settentrionale e l'Appennino Centrale per il cap. G. Roggero.

The paper is illustrated by a diagrammatic map showing the line of division which the author claims to be the natural separation between the northern and central divisions of the Appenines. It runs from Arezzo across the pass known as Bocca Trabaria, and follows the river Metauro from its source to the Adriatic Sea at Fano.

Lipari Islands. **Ludwig Salvator.**

Die Liparischen Inseln. Drittes Heft. Lipari. Prag, H. Mercy, 1894. Size 16½ × 13, pp. xvi. and 158. *Maps and Illustrations. Presented by the Archduke Ludwig Salvator.*

This is the continuation of the most sumptuously printed and illustrated geographical memoir recently published.

Scotland—West Highlands.

Mountain, Moor, and Loch, illustrated by Pen and Pencil, on the route of the West Highland Railway. London, Sir Joseph Causton & Sons, 1894. Size 9 × 6, pp. 180. *Illustrations. Presented by the Manager of the North British Railway.*

A finely illustrated official guide to the West Highland Railway, which opened for traffic in August last. The line runs from Helensburgh along the east side of the Gareloch and Loch Long to Arrochar, thence by the west side of Loch Lomond up Glenfalloch, crossing the Callander and Oban line, and across the Moor of Rannoch between Loch Rannoch and Loch Lydoch, thence by Loch Treig and down Glen Spean to Fort William.

Spain and its Colonies—Dictionary. **Castillo.**

Gran Diccionario geográfico, estadistico é histórico de España y sus Provincias de Cuba, Puerto Rico, Filipinas y posesiones de Africa. . . . Esta obra se publica bajo la dirección de D. Rafael del Castillo con la colaboración de notables escritores y artistas. Tomo IV. [T—Z]. Barcelona, Henrich & Co., 1892. Size 13 × 9, pp. 546. *Map. Price* 22*s.* 6*d.*

This volume carries the Gazetteer of Spain and its Colonies from Tabaco to Zuya, completing the work. It concludes with a list of about 15,000 names alphabetically arranged, and a large map of Spain containing a good deal of unusual information.

ASIA.

India—Geology. **Oldham.**

A Manual of the Geology of India. Chiefly compiled from the observations of the Geological Survey. Stratigraphical and Structural Geology. Second Edition, revised and largely rewritten by R. D. Oldham. Calcutta; London, Trübner & Co., 1893. Size 10½ × 7½, pp. xxiii. and 543. *Maps and Plates. Price* 16*s. Presented by the Geological Survey of India.*

Mr. Oldham's recent paper in the *Journal* on the geological history of India afforded our readers an opportunity of judging of his fitness to bring this manual abreast of the results of current science; he has succeeded in making his descriptions readable as well as authoritative.

Indian Ocean. **Venukoff.**

The Indian Ocean. By M. Venukoff. [In Russian.] Size 10 × 6½, pp. 20. *Presented by the Author.*

Malay Archipelago—Celebes—Bareo Language. **Kruyt.**

Woordenlijst van de Bareë-Taal, gesproken door de Alfoeren van Centraal Celebes beoosten de rivier van Poso, beneveno de Topebato-Alfoeren bewesten genoemde rivier. Door Alb. C. Kruyt. Uitgegeven door het koninklijk Instituut voor de Taal-, Land-, en Volkenkunde van Nederlandsch-Indië. The Hague, Martinus Nijhoff, 1894. Size 10 × 6½, pp. 122.

Malay Archipelago—Ceram. **Boot.**

Tijdschr. Nederlandsch Aardrijksk. Genoots. **10** (1893): 650-678, 885-902, 1163-1204. Korte Schets der Noord-Kust van Ceram. Door J. Boot.

This is a posthumous work of the late military governor of the Wahai division. The name of the author is given erroneously in the first two parts as W. G. Boot.

Malay Archipelago—Sumatra. **Dijk.**

Tijdschr. Nederlandsch Aardrijksk. Genoots. **10** (1893): 1076-1091.

Rapport omtrent het onderzoek naar de mogelijkheid en wenschelijkheid om eenen voor voertuigen geschikten de Uitwataing van het Toba-meer en het in de residentie Sumatra's oostkust gelegen Bandar Poelo. Door P. A. L. E. van Dijk. *With Map.*

Philippines—Magnetic conditions. **Cirera.**

El Magnetismo Terrestre en Filipinas por el P. Ricardo Cirera. Manila, 1893. Size 12½ × 9, pp. 158.

This is a very important contribution to our knowledge of the distribution of terrestrial magnetism. It gives a full account of the instruments and methods employed at the Manila Observatory, and is furnished with a series of maps showing the magnetic conditions, as well as with a great number of diagrams.

Shan Names.

Tables for the Transliteration of Shan Names into English. Rangoon, 1892. Size 9½ × 6½, pp. 12.

Siberia—Yakuts district. **Maydell.**

Reisen und Forschungen im Jakutskischen Gebiet Ostsibiriens in den Jahren 1861-1871, von Baron Gerhard Maydell. Erster Theil (Band I. Vierte Folge Beiträge zur Kenntniss des Russischen Reiches und der angrenzenden Länder Asiens . . . herausgegeben von L. v. Schrenck und Fr. Schmidt) St. Petersburg, Kaiserlich Akademie der Wissenschaften, 1893. Size 10 × 7, pp. xx. and 708. *Price* 19*s*. *Presented by the Imperial Academy of Sciences, St. Petersburg.*

Baron Gerhard Maydell has spent twenty-four years in Siberia studying the country, and this volume gives the first part of his account of the results of ten years spent in the Yakuts country in the extreme north-east of Asia. It is planned in the form of a narrative of travel, and each important stage of his journey forms a chapter.

AFRICA.

Algeria and Tunis. *Nouvelles Archives Missions Scientifiques* **4** (1893) : 285-434. **Diehl.**

Rapport sur deux missions archéologiques dans l'Afrique du Nord (Avril-Juin, 1892, et Mars-Mais, 1893). Par M. Diehl, professeur à la Faculté des Lettres de Nancy.

A study of the archæology of Algeria and Tunis, particularly of the Byzantine ruins. The memoir is illustrated by numerous photographs.

British Central Africa—Shire. *Petermanns M.* **40** (1894) : 165-166. **Merensky.**

Der Shire-Fluss. Von Missionssuperintendent, Dr. A. Merensky. *With Map.*

Cape Colony—Transkei. *T. South African Philos. S.* **8** (1890-92) : 1-11. **Schunke.**

The Transkeian Territories, their Physical Geography and Ethnology. By H. C. Schunke.

This is an attempt to give a succinct account of the geography of "Kaffraria proper," which lies in the extreme south-east of Africa, bordering Natal.

Congo State. **Bailey.**

Travel and Adventures in the Congo Free State and its Big Game Shooting. By Bula N'Zau [Henry Bailey]. Illustrated from the Author's sketches. London, Chapman and Hall, Ltd., 1894. Size 9½ × 6, pp. xviii. and 336. *Price* 14*s*. *Presented by the Publishers.*

This book is confined to a record of the sport obtained by the author during the four years of his service in the Congo State. There is a route map, and there are several sketches of hunting adventures.

East Africa. *Sitzb. k. preussischen. A.W. Berlin* (1894) : 3-21. **Dillmann.**

Ueber die geschichtlichen Ergebnisse der Th. Bent' schen Reisen in Ostafrica. Von A. Dillmann.

A piece of historical research into the origin of the builders of Zimbabwe and other ancient African structures.

French West Africa. **Laumann.**

A la Côte occidentale d'Afrique. Par E.-M. Laumann. Préface de Jean Bayol. Paris, Firmin-Didot & Co., 1894. Size 8 × 5¼, pp. vii. and 266. *Maps and Illustrations. Price* 3 *fr*. 50 *c*.

A popular account of a visit to Konakry and to the Susu country.

French West Africa. *Ann. G.* **3** (1894) : 409-427. **Monnier.**

Une Jeune Colonie. Côte d'Ivoire et Soudan meridionale. Par M. Marcel Monnier. *Illustrations.*

Madagascar. *Ann. G.* **3** (1894) : 499-517. **Gautier.**

Mission Emile Gautier à Madagascar. Par Emile Gautier.

The work here described was done in the region between 18° and 21° S. lat. and between 43° and 47° W. long. This included the entirely new itineraries from Ambiky to Ankavandra-Ambohitsalika, and from Manandaza to Mahabo.

South Africa. *T. South African Philos. S.* **8** (1890–92): 12–15. **Schunke.**

Notes on the Orography and Climatic condition of South-Eastern Africa, and on the migration of natives. By H. C. Schunke.

The historical facts as to the power of South African natives to become acclimatized to unhealthy regions suggest "the question of reserving the large tracts of comparatively unhealthy but exceedingly fertile country north of the Limpopo for our Cape and Natal natives. . . . The removal will not take place to-day, but it is well to think of such a question in good time."

South Africa. *T. South African Philos. S.* **8** (1890–92): 16–22. **Liebman.**

Mashonaland and Matabeleland. Facts and Figures. A reply to Mr. Schunke.

A caustic criticism of Mr. Schunke's paper on the orography and climatic conditions of South-Eastern Africa noted above.

South-West Coast. *T. South African Philos. S.* **5** (1886–88): 326–329. **Wilmer.**

The relation of the sand-dune formation on the south-west coast of Africa to the local wind currents. By H. Carrington Wilmer.

NORTH AMERICA.

United States—Carolina. **Hughson.**

Johns Hopkin's University Studies. Twelfth Series. V., VI., VII. The Carolina Pirates and Colonial Commerce, 1670–1740. By Shirley Carter Hughson. Baltimore, 1894. Size 9½ × 6, pp. 134.

A history of the doings of the pirates of the coasts of the two Carolinas during the seventeenth and eighteenth centuries.

United States—Maryland. ——

U.S. Department of Agriculture, Weather Bureau. The Climatology and Physical Features of Maryland. First Biennial Report of the Maryland State Weather Service for the years 1892 and 1893. Baltimore, 1894. Size 10 × 7, pp. 140. *Maps and Plate.*

United States—North Carolina. **Pinchot.**

Biltmore Forest, the property of Mr. George W. Vanderbilt. An account of its treatment, and the results of the First Year's Work. By Gifford Pinchot. Chicago, 1893. Size 5½ × 8, pp. 49. *Map and Illustrations.*

The Biltmore Estate, of which the Biltmore Forest constitutes a little over one-half, is situated in the western part of North Carolina, on the right and left banks of the French Broad River, in latitude 35° 33′ N., longitude 82° 33′ W.

United States—Oregon—Tacoma. *Sierra Club B.* **1** (1894): 109–132. **Trump.**

Mount Tahoma. A narrative of an ascent of the mountain by its western slope, being an exploration of Crater Peak and North Peak. By P. B. Van Trump. *With Illustrations.*

United States—Pennsylvania. *P. American Philos. S.* **33** (1894): 114–134. **Rothrock.**

Forests of Pennsylvania. By J. T. Rothrock.

This paper treats of the kinds of timber trees in Pennsylvania, the most important forest areas of the State, the configuration of Pennsylvania in relation to the growth of timber, rates of growth of timber trees, and obstacles to growth both natural and due to human agencies. It concludes with an account of the attitude of the State with regard to forest restoration, and a discussion of the methods of forest restorations.

United States—Rivers, etc. ——

Annual Report of the Chief of Engineers, United States Army, to the Secretary of War, for the year 1893. 6 Parts. Washington, 1893. Size 9 × 6, pp. 4404. *Maps and Plates. Presented by the Engineer Department, U.S. Army.*

Contains full details of the operations of the U.S. Engineer Department for the fiscal year ending June 30, 1893, with the Reports of the Mississippi and Missouri River Commissions.

CENTRAL AND SOUTH AMERICA.

Andes. *Globus* **65** (1894): 324–326. **Martin.**

Neue Beobachtungen in den patagonischen Anden. Von Dr. Karl Martin.

Argentine and Chile. *M.G. Ges. Wien* **37** (1894): 225–263. **Polakowsky.**

Die Entwickelung von Argentinien und Chile in den Jahren, 1889–1893. Von Dr. H. Polakowsky.

An account of recent progress in the two southern republics of South America with regard to exploration and to the economic development of the countries.

Bolivia. *Scottish G. Mag.* **10** (1894): 302–312, 360–371. **Urquhart.**

The Bolivian Altiplanicie. By D. R. Urquhart.

Brazil—Minas Geraes. **Lacerda.**

Organisação e Trabalhos de Commisão Geographica e Geologica do Estado de Minas Geraes por Augusto de Abreu Lacerda, Engenheiro Chefe. *Commissão Geographica e Geologica do Estado de Minas Geraes. Boletim* No. 1. Size 10 × 6½, pp. 70. Rio de Janeiro, 1894.

Brazil—Rio Grande do Sul. **Ihering.**

Deutsche Rundschau G. **16** (1894): 337–348, 403–409, 459–464.

Aus meinem Leben und über meine Thätigkeit in Rio Grande do Sul. Von Dr. Hermann von Ihering in São Paulo. *With Portrait.*

Dr. Ihering's work lay mainly in the study of the fauna of the state of Rio Grande do Sul, and his autobiographical article is terminated by a list of his published writings.

Colombia—Ruins. **Cuervo Marquez.**

Carlos Cuervo Marquez, Prehistoria y Viajes. Tierradentro, Los Paeces, San Agustin, El Llano, etc., etc. 1893. Bogotá (Colombia). Size 9½ × 6½, pp. 248. *Illustrations. Presented by the Author.*

An archæological journal of a tour through parts of Colombia, with notes on native customs and beliefs.

Ecuador—Cayapas. *Tour du Monde* **67** (1894): 401–416. **Basurco.**

Trois semaines chez les Indiens Cayapas (République de l'Ecuador). Par M. Santiago M. Basurco, Ingénieur civil.

M. Basurco's journey to the Cayapas river took place in 1891-92. This account of it is illustrated with some highly characteristic groups of natives.

Peru—Chucuito. *B.S.G. Lima* **3** (1894): 365–373. **Basadre.**

Puno. Provincia de Chucuito, por D. Modesto Basadre.

AUSTRALASIA.

Australia—Railways. **Kandt.**

Ueber die Entwickelung der Australischen Eisenbahnpolitik nebst einer Einleitung über das Problem der Eisenbahnpolitik in Theorie und Praxis. Von Dr. Moritz Kandt. Berlin, H. Mamroth, 1894. Size 9 × 6, pp. xxxiv. and 263.

An essay on the Australian railway policy, including an historical account of the origin of the government railways of Victoria, and the history of the railway system in that colony.

New Guinea. **Macgregor.**

Despatch from His Honour the Administrator of British New Guinea, reporting the proceedings in connection with the Delimitation of the Boundary between British and Dutch New Guinea, 1893. Size 13½ × 8½. *Maps. Presented by the Secretary of State for the Colonies.*

The two maps accompanying this despatch show: Map No. 1, the position of the present and of the proposed boundary; Map No. 2, the coast-line of the district immediately adjoining the Bensbach, and the course of that river, ascended by Sir William Macgregor some ten miles. See this *Journal*, vol. ii. p. 270.

New Guinea—Humboldt Bay. *Rev. G.* **34** (1894): 410–416. **Estrey.**

La baie de Humboldt (Nouvelle Guinée). Par H. Meyners D'Estrey.

An account of the explorations carried out by M. Bink, for the Dutch Geographical Society, in New Guinea. He lived for three months on the shore of Humboldt Bay, examining the surrounding country and studying the people. A sketch-map is given showing Humboldt Bay and the Santani lake which lies inland from it.

New South Wales. *J. S. Arts* **42** (1894): 666-676. **Inglis.**

The Industries and prospective sources of wealth in New South Wales. By the Hon. J. Inglis. With Discussion.

North Australia and New Guinea. *Verh. Ges. Erdk. Berlin* **21** (1894): 272-289. **Semon.**

Reisen in Nord-Australien und Neu Guinea. Von Prof. Dr. Richard Semon.

Torres Strait. *T. R. Irish A.* **30** (1894): 419-476. **Haddon, etc.**

On the Geology of Torres Straits. By Professors A. C. Haddon, W. J. Sollas, and G. A. J. Cole. *Plates.*

The paper includes a general account of the physical features of Torres Straits and of its volcanic and coral islands. It will be referred to elsewhere in the *Journal*.

POLAR REGIONS.

Antarctic—Animal Life. **Bruce.**

Animal Life observed during a Voyage to Antarctic Seas. By W. S. Bruce, Naturalist to the s.s. *Balæna*. [Reprinted, May 9, 1894, from the *Proceedings* of the Royal Physical Society of Edinburgh, vol. xii.] Size 8½ × 5½. *Presented by the Author.*

Kara Sea. **Peel.**

Polar Gleams: an Account of a Voyage on the yacht *Blencathra*. By Helen Peel. With a Preface by the Marquess of Dufferin and Ava, and contributions by Captain Joseph Wiggins and Frederick G. Jackson. London, Edward Arnold, 1894. Size 9 × 6, pp. xvii. and 211. *Map, Portrait, and Illustrations. Price* 15*s. Presented by the Publisher.*

A pleasantly written little book, giving a lively picture of the first yacht voyage through the Kara Sea. The author and her hostess were the first ladies who have traversed the future sea-route to Siberia, and she has given a most creditable account of her experiences.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Astronomy. *J. Manchester G.S.* (1892): 211-225. **Weir.**

Astronomy in Relation to Geography. By Mr. Thomas Weir.

Atmosphere. **Langley.**

Smithsonian Contributions to Knowledge, 1884. The Internal Work of the Wind. By S. P. Langley. Washington, 1893. Size 13½ × 10, pp. 23. *Plates.*

This memoir shows that wind is not a uniformly moving mass of air, but consists of successive brief pulsations giving a potentiality of "internal work" by means of which not only may many of the phenomena of a soaring bird be explained, but suitably constructed flying-machines might be sustained and propelled through the air.

NEW MAPS.

By J. Coles, *Map Curator*, R.G.S.

EUROPE.

Brighton. **Bartholomew.**

Plan of Brighton from the Ordnance Survey. Scale 4·7 inches to a mile. W. H. Smith & Son's series of Reduced Ordnance Maps for Tourists. By J. Bartholomew, F.R.G.S. London, W. H. Smith & Son. *Price* 1*s., mounted on cloth. Presented by Messrs. J. Bartholomew & Co.*

This map belongs to Bartholomew's reduced Ordnance Survey series; it is very clearly drawn, and the heights above sea-level are given. It is accompanied by an index, by the aid of which any street can be readily found.

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1 : 100,000 or 1·7 stat. miles to an inch. Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme, 1894. Sheets:—45, Lanenburg in Pom; 123, greifenberg i. Pom; 124, Schivelbein; 125, Polzin; 220, Arnswalde; 300, Buk; 644, Freiburg i. Breisgau. *Price* 1·50 *marks each sheet.*

Scotland. **Bartholomew.**

Bartholomew's Reduced Ordnance Survey of Scotland. Scale 1 : 126,720 or 2 stat. miles to an inch. New Series. Sheet 16. Braemar and Blair Atholl. J. Bartholomew & Co., Edinburgh, 1894. *Price 2s., mounted on cloth. Presented by the Publishers.*

This map is a reduction from the Ordnance Survey; it is contoured and orographically coloured. All means of communication are very clearly shown. Main driving roads are coloured brown; other roads are shown by double lines, and railroads by a thick black line; footpaths, bridle roads, and parish boundaries are also indicated.

Scotland. **Collins.**

Twelve Charts of the Tidal Streams on the West Coast of Scotland, by F. Howard Collins. London, J. D. Potter, 1894. *Price 5s. Presented by the Author.*

This atlas contains twelve charts of the west coast of Scotland, on which the directions of the tidal streams from Cape Wrath to Wigton Bay at all hours of the tide, and upon any day of the year, are shown by arrows, which have been placed in accordance with the information contained in the Admiralty Sailing Directions, the Tide Tables for the British and Irish Ports, 1894, and Archibald Smith's paper in the *Proceedings* of the Royal Society, "On the Tidal Currents on the West Coast of Scotland." Full directions are given at the beginning of the atlas for the manner in which the charts can be used.

AFRICA.

British South Africa. **Stanford.**

Stanford's Map of British South Africa. Scale 1 : 5,977,382 or 94·3 stat. miles to an inch. E. Stanford, London, 1894. *Presented by the Publisher.*

In this map all the political divisions are shown, and the railways have been brought up to date. The heights are given in feet. It is clearly drawn, and is a useful map for general reference.

Upper Congo Region. **Cornet.**

Geognostische Übersicht des Südlichen Teiles des Kongo-Gebietes. Nach eigenen Aufnahmen gezeichnet von Dr. J. Cornet. Scale 1 : 2,000,000 or 31·4 stat. miles to an inch. 'Petermanns Geographische Mitteilungen,' Jahrgangang, 1894, Tafel 10. Justus Perthes, Gotha.

West Africa. **Geographical Society of Berlin.**

Übersicht der Reisewege der deutschen Kamerun-Expedition, 1893–1894. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. Gesellschaft für Erdkunde zu Berlin. Sitzung vom 7, Juli, 1894. *Presented by the Geographical Society of Berlin.*

AMERICA.

Argentine Republic. **Museo de La Plata.**

Mapa de la Provincia de Catamarca, construido segun datos recogidos y observaciones perdonales hechas en los años 1887–93 por Gunardo Lange, Ingeniero, director de la Seccion Topográfica del Museo, y dibujado por Enrique Delachaux, Cartógrafo, director de la Seccion Cartográfica del mismo Establecimiento, 1893. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Museo de La Plata. 4 sheets. *Presented by the Directors of the Museum of La Plata.*

This map has been compiled from the latest official documents and surveys. The importance of each town is indicated by the symbol employed to mark its position, all railways in operation, as well as those which are projected, are laid down, and the positions of springs, marshes, and mines are indicated. Care has been taken to lay down all boundaries accurately, and a note is given in which mention is made of all the authorities consulted in the construction of the map. An inset of the northern part of Catamarca is given on a smaller scale.

United States. **Rand, McNally & Co.**

Rand, McNally & Co.'s Indexed County and Railroad Pocket Map and Shippers' Guide of New York (scale 1 : 840,000 or 13·2 stat. miles to an inch) and Pennsylvania (scale 1 : 765,000 or 12·1 stat. miles to an inch). Rand, McNally & Co., Chicago and New York, 1894. *Presented by the Publishers through E. Stanford, Esq.*

Stanford.

Stanford's General Map of the United States. Scale 1 : 5,274,720 or 83·25 stat. miles to an inch. E. Stanford, London, 1894. *Presented by the Publisher.*

GENERAL.

World. **Herrich.**

Weltverkehrskarte. Entworfen von A. Herrich. Carl Flemming's Generalkarten No. 51. Äquatorial-Massstat 1 : 50,000,000 or 11½ degrees to an inch. Druck und verlag von Carl Flemming in Glogau. *Price mark* 1·50.

Historical Geography. **Schrader.**

Atlas de Géographie Historique. Ouvrage contenant 54 grandes Cartes doubles en couleurs, accompagnées d'un Texte Historique au dos et d'un grand nombre de Cartes de Détail, Figures, Diagrammes, etc. Par une Réunion de Professeurs et de Savants sous la direction Géographique de F. Schrader, directeur des travaux cartographiques de la librairie Hachette et C^ie^. Paris, Hachette et C^ie^, 1894. Livraison. *Price 1fr.* 50c. *Presented by the Publishers.*

Sheet 10 contains maps of the Roman possessions in 146 B.C. and 30 B.C., the Roman World and the Barbarian World at the time of the Cimbrian invasion, and the Orient at the time of Mithridates. Sheet 22 is a map showing the partition of Germany and the progress of France, with three insets of France in 1515, 1610, and 1659. Sheet 41 is a map of Central and Western Germany in 1798, with insets of the ecclesiastical principalities in 1789, and the free-cities 1789. As usual with this atlas, each map is accompanied by well-written historical notes.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published at the Hydrographic Department, Admiralty, May and June, 1894. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
1464	m = 2·95	England, west coast :—Menai Strait. 2*s.* 6*d.*
2303	m = 1·4	Norway, west coast :—Approaches to Bergen. 2*s.* 6*d.*
2061	m = 1·73	White sea :—Approaches to Kem. 1*s.*
1770	m = 4·2	Black sea :—Port of Liban. 1*s.* 6*d.*
1774	m = 0·5	Spain, south-east coast :—Adra to Cartagena. 2*s.* 6*d.*
1804	m = 0·5	France and Spain, south coast :—Cape St. Sebastian to Cette. 3*s.*
367	m = 7·2	France, south coast :—Port of Cette. 1*s.* 6*d.*
2021	m = 6·0	Greece, entrances to Corinth Canal :—Corinth roads, Kalamaki Bay. 1*s.* 6*d.*
1910	m = 0·25	Mediterranean, Algeria :—Algier to Cape Bongaroni. 2*s.* 6*d.*
1909	m = 0·25	Mediterranean, Algeria :—Cape Ivi to Algier. 2*s.* 6*d.*
867	m = 3·97	Bermuda Islands :—The Narrows to Hamilton. 3*s.*
2141	m = 1·0	Newfoundland, south-west coast :—Indian Harbour to Cape Ray. 3*s.*
2464	m = 0·5	Madagascar, west coast :—Nosi Andrianmitarika (Crab Island), to Manananoka Point (Black Point). 2*s.* 6*d.*
855	m = various.	Sumatra, west coast :—Banjak Islands and adjacent coast of Sumatra, Tapanuli Bay, and Pulo Mansalar, Tapanuli harbour, Tapus Road. 1*s.* 6*d.*
380	m = 5·96	China, Hong Kong :—Taitam Bay. 1*s.* 6*d.*
383	m = 6·0	Australia, north coast :—Thursday Island harbour. 1*s.* 6*d.*
2919	m = 0·5	Australia, east coast :—Cape Grenville to Cape York. 2*s.* 6*d.*
1301		Plans on the Coast of Chile :—Plan added, Blanco Encalada.
1454		Anchorages in Alaska :—New Plan, Chernoffski harbour.

J. D. Potter, agent.

Charts Cancelled.

No.		Cancelled by	No.
1464	Menai Strait.	New Chart. Menai Strait.	1464

No.	Cancelled by	No.
2304 Plan of approaches to Bergen on this sheet.	New Chart. Approaches to Bergen.	2303
2605 Plan of port of Cette on this sheet.	New Plan. Port of Cette.	367
2603 Palamos to Cape Béarn.	New Plan. Cape St. Sebastian to Cette.	1804
867 The Narrows to Ireland Island.	New Plan. The Narrows to Hamilton.	867
693 The western coast of Madagascar, from Murderers' Bay to Cape St. Vincent.	New Chart. Nosi Andrianmitarika (Crab Island), to Mananonoka Point (Black Point)	2464
855 Anchorages on the west coast of Sumatra.	New Plans. Anchorages on the west coast of Sumatra.	855

1381 Plan of Benzert Road on this sheet.
856 Plan of Tomman, or Uru Island, on this sheet.

Charts that have received Important Corrections.

No. 1905 England, south coast:—Southampton Water. 2631 England, south coast:—Portsmouth Harbour. 154 England, south coast:—Approaches to Falmouth. 1481 Scotland, east coast:—River Tay. 2328 Norway:—Christiansand to Sandö. 2256 Baltic:—River Dvina, from the roadstead to town of Riga. 2138 Denmark:—Approaches to the Grön Sound and the Stör Strom. 1367 Greece:—Corinth Bay and Isthmus. 1569 Africa, north coast:—Approaches to Benzert. 1381 Africa, north coast:—Benzert lakes. 360 North Atlantic Ocean:—Bermuda Islands. 2282 Arctic Ocean and Greenland Sea. 2580 Cuba, eastern portion. 1639 Gulf of Mexico:—Coasts of Louisiana and Texas from the Mississippi river to Boquillas Cerrados. 2854 Gulf of Mexico:—Tampico harbour. Approaches to Vera Cruz. 1927 Central America:—Corinto harbour (Port Realejo). Acajutla anchorage. 2689 North America, west coast:—Haro and Rosario Straits. 1922 North America, west coast:—Fraser river and Burrard inlet. 1500 Aleutian Islands:—Kadiak Island to Signam Island. 1036, Madagascar:—Anchorages on the coast of Madagascar. 40 India, west coast:—Karáchi harbour. 737 India, west coast:—Sheet 3; Arnala Island to Kundari. 2578 Sulu or Mindoro Sea, eastern part. 2577 Philippine Islands:—Between St. Bernardino and Mindoro Straits, with adjacent islands. 1270 China:—Approaches to Chemulpho anchorage. 1011 Russian Tartary:—Eastern Bosporus Strait. 856 Anchorages in New Hebrides Islands. 1730 Pacific:—Samoa or Navigator Islands.

J. D. Potter, agent.

N. Atlantic and N. Pacific Oceans. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic and North Pacific Oceans for July, 1894. Published monthly at the Hydrographic Office, Bureau of Navigation, Washington, D.C. Charles D. Sigsbee, Commander U.S. Navy, Hydrographer. *Presented by the U.S. Hydrographic Office.*

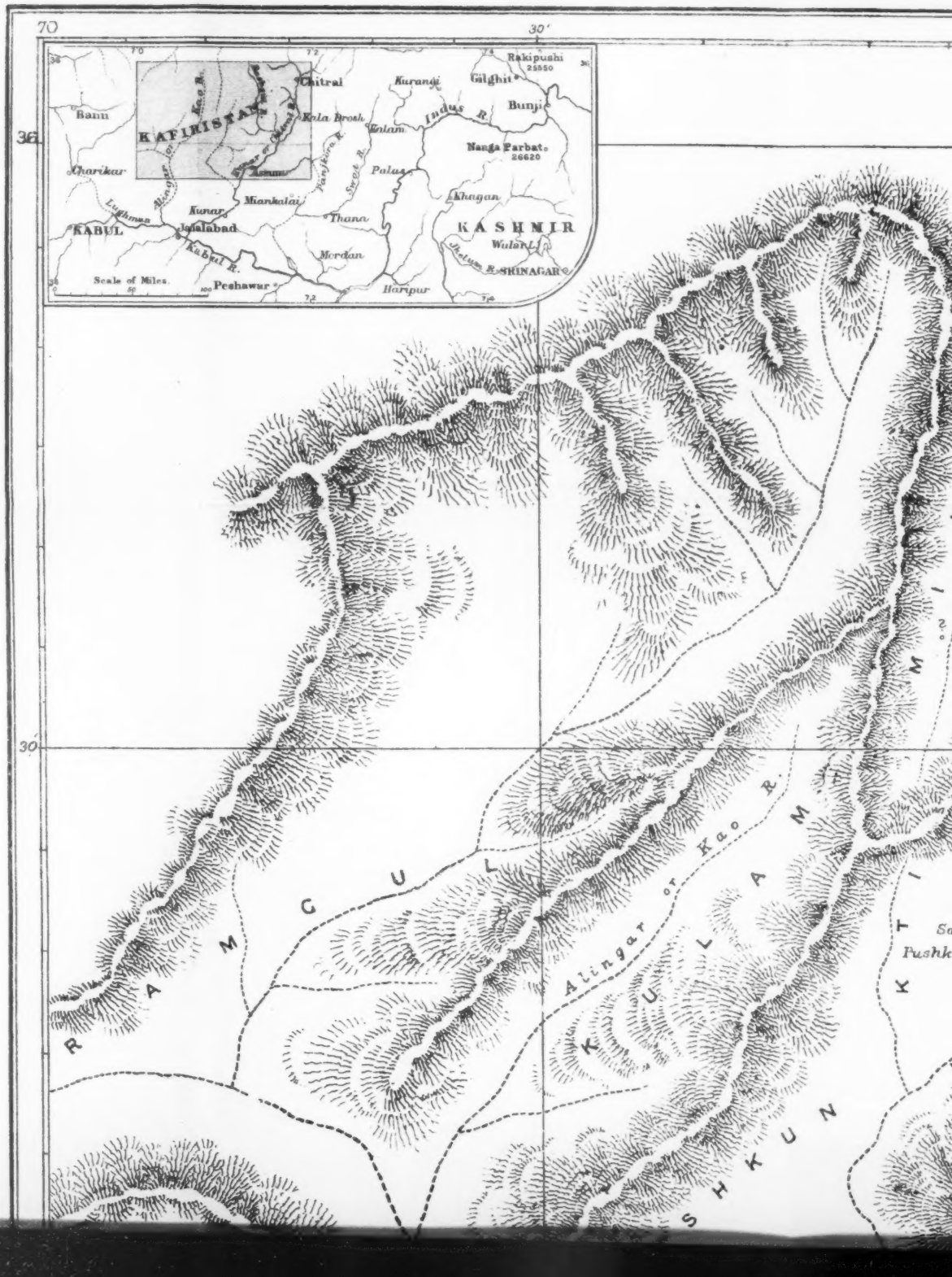
PHOTOGRAPHS.

Morocco. **Howard.**

38 Photographs of Morocco, taken by Esme Howard, Esq. *Presented by Esme Howard, Esq.*

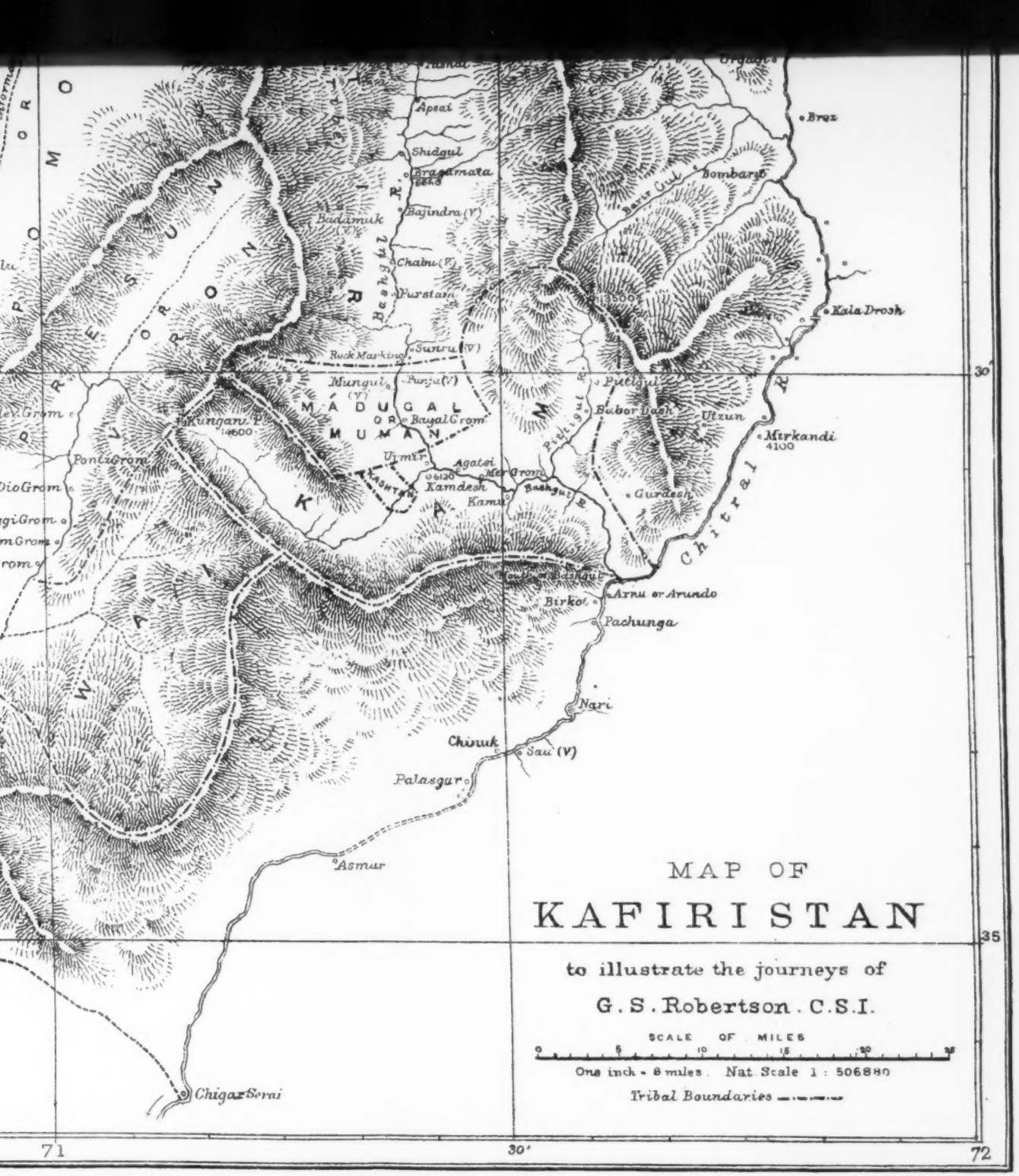
This is a very nice series of photographs containing characteristic views taken by Mr. Esme Howard in Morocco. They embrace scenery and buildings in Tangier, Mazan, Tetuan, Fez, Mekenez, and other places.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


70
30'
36
30
Bann
Charikar
KAFIRISTAN
Chitral
Asmar
Kala Brosh
Kurangi
Gilgit
Rakipushi
25550
Bunji
Indus R.
Nanga Parbat
26620
Palas
Khagan
KASHMIR
Wular L.
Jhelum R.
SRINAGAR
Thana
Miankalai
Kunar
Jalalabad
KABUL
Lughman
Kabul R.
Mardan
Peshawur
Haripur
Scale of Miles.
RAMCULA
Alingar or Kao R.
KULAM
SHKUN

71
30'
72
36
30'
Pup (V)
Camp
Mandali Pass
Ahad Dowra
Pine
Chitral
4980
Jaghur
Chamarkand
Urgach
Broz
Shidgul
Pashal
Apsai
Bragamata
6663
Bombarie
Barsa Gul
Bajindra (V)
Badamuk (V)
Chabu (V)
Purstan
Tullu
Kala Drosh
Rock Marking
Sunru (V)
Mungul (V)
Punju (V)
Putigul
Bubor Dash
Utzun
Mirkandi
4100
Shiver Grom
Kungani
4600
Bayal Grom
Ponti Grom
Dio Grom
Stiggi Grom
Satsum Grom
Pushki Grom
Urmir
Agatsi
Mer Grom
6120
Kamdesh
Kamu
Gurdesh
Bashgul R.
Arnu or Arundo
Birkot
Pachunga
Nari
Chiruk
Sau (V)
Palasgar
Barenis
Bashgul R.
Putigul R.
Chitral R.
MADUGAL OR MUMAN
KASHTIA
KAMDESH
WAIGAL
KAMA
PRESUN
MORUJ
KUNJAR
from Native information only

Published by the R



MAP OF
KAFIRISTAN

to illustrate the journeys of

G. S. Robertson. C.S.I.

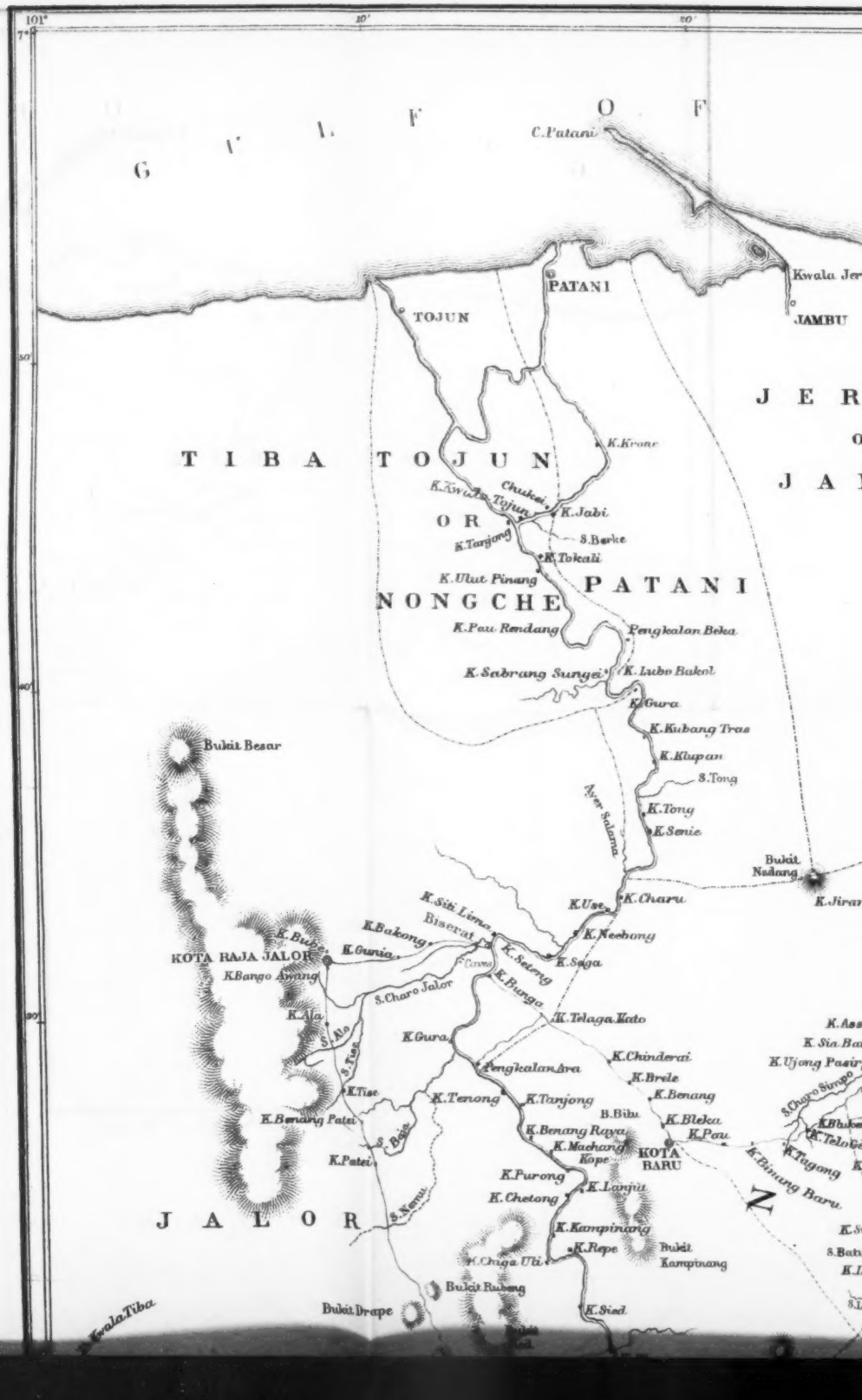
SCALE OF MILES

0 5 10 15 20 25

One inch = 8 miles. Nat. Scale 1 : 506880

Tribal Boundaries

the Royal Geographical Society.


C. Patani
PATANI
TOJUN
JAMBU
TIBA TOJUN
OR
NONGCHE PATANI
K. Jabi
S. Berke
K. Tokali
K. Pau Rendang
Pengkalan Beka
K. Sabrang Sungei
K. Lubo Bakol
K. Gura
K. Kubang Tras
K. Kupan
S. Tong
K. Tong
K. Senie
Ayer Salama
Bukit Besar
Bukit Nalang
K. Charu
K. Uset
K. Sitik Lima
Biserat
K. Bakong
K. Nechong
K. Setong
K. Saga
K. Gunia
KOTA RAJA JALOR
K. Bango Awang
S. Charo Jalor
K. Burga
K. Telaga Kato
K. Gura
K. Chinderai
Pengkalan Ara
K. Brele
K. Benang
K. Tenong
K. Tanjong
K. Tise
K. Benang Patei
K. Benang Raya
K. Machang
Kope
KOTA BARU
K. Patei
K. Purong
K. Lanjut
K. Chetong
JALOR
K. Kampinang
K. Rope
Bukit Kampinang
Bukit Rubeng
Bukit Drape
K. Sied
Kwala Tiba

MAP OF THE

TELUBIN AND PATANI VALLEYS

SIAMESE MALAY STATES.

from Surveys made by

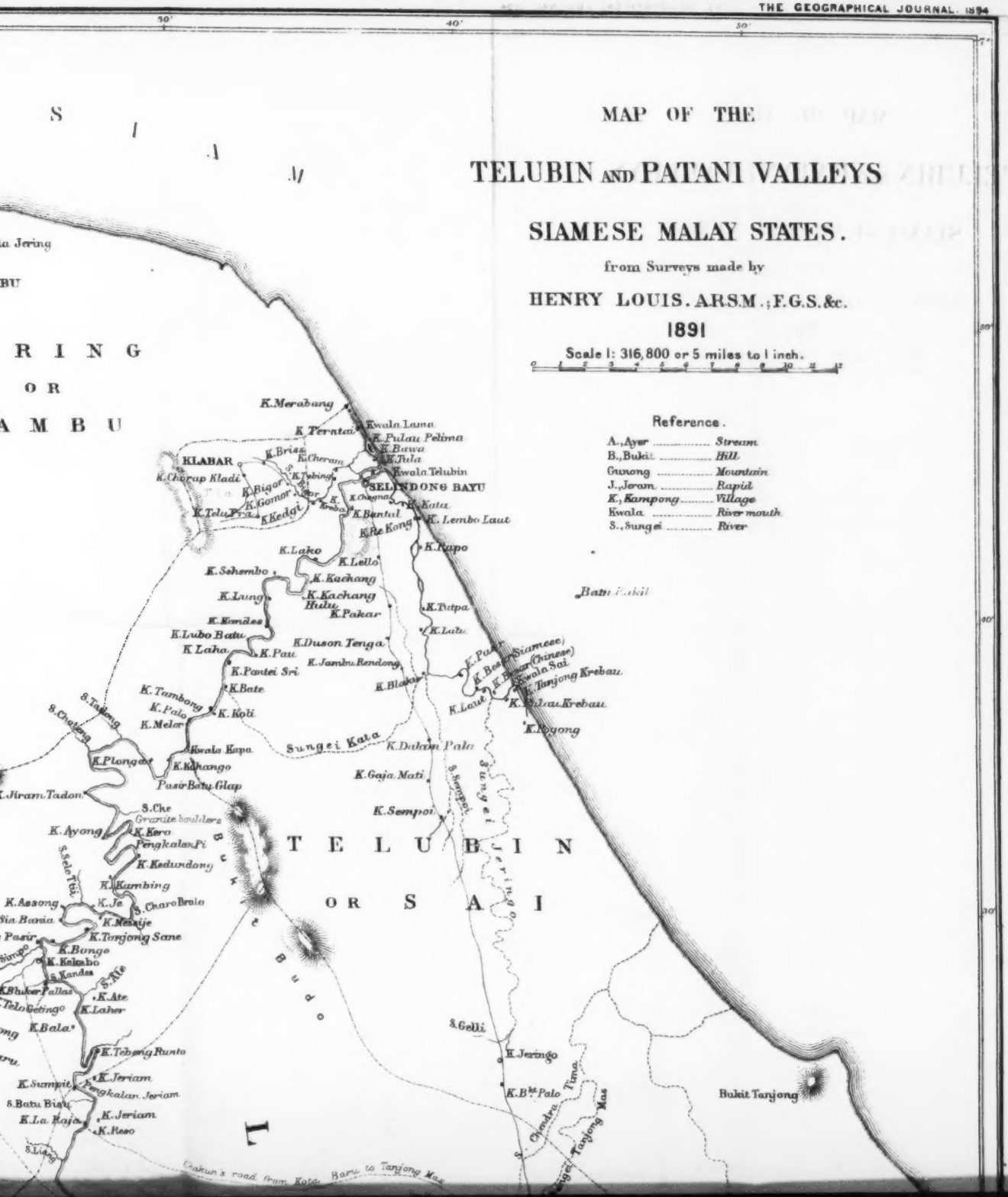
HENRY LOUIS. A.R.S.M.; F.G.S. &c.

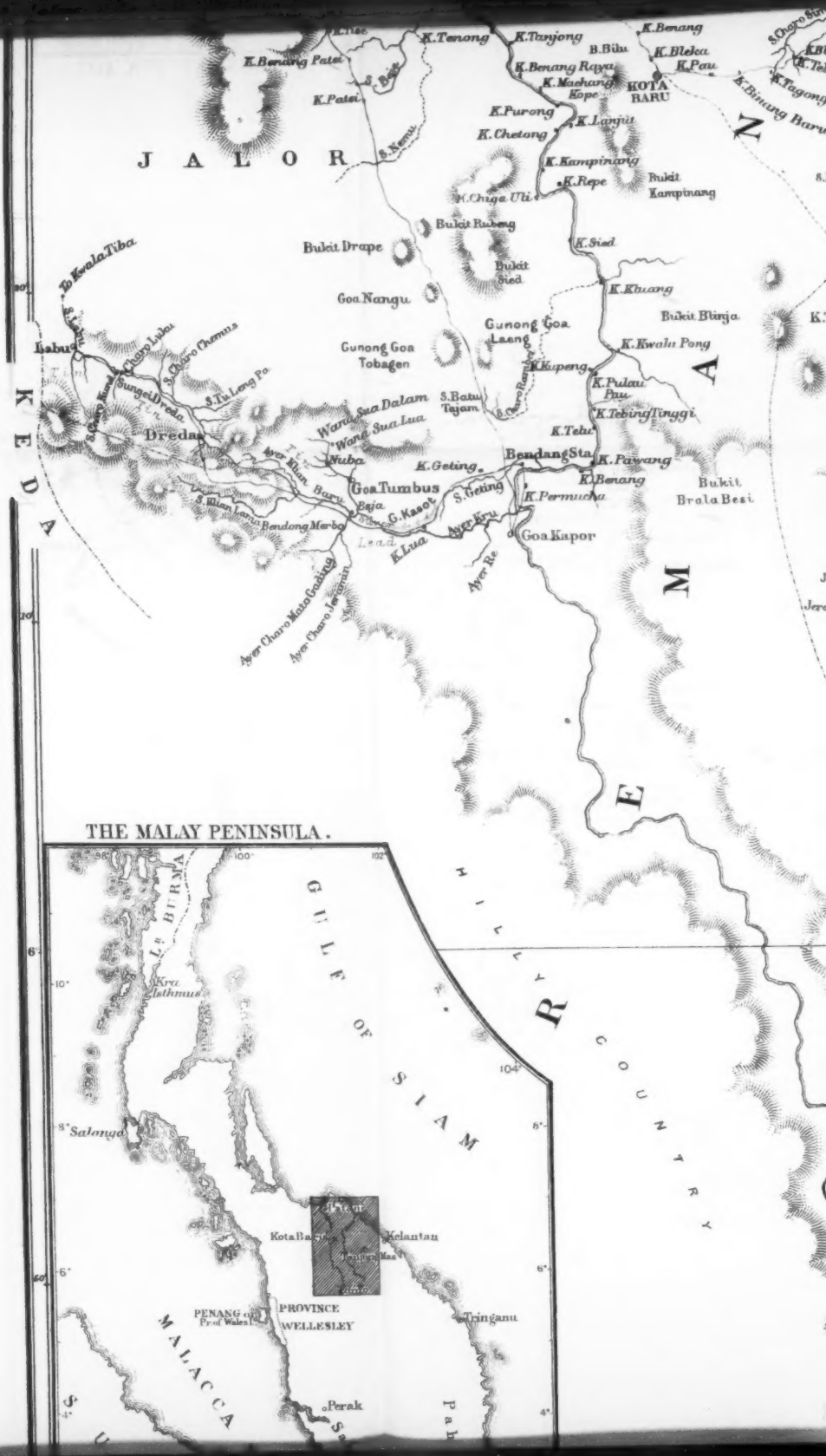
1891

Scale 1: 316,800 or 5 miles to 1 inch.

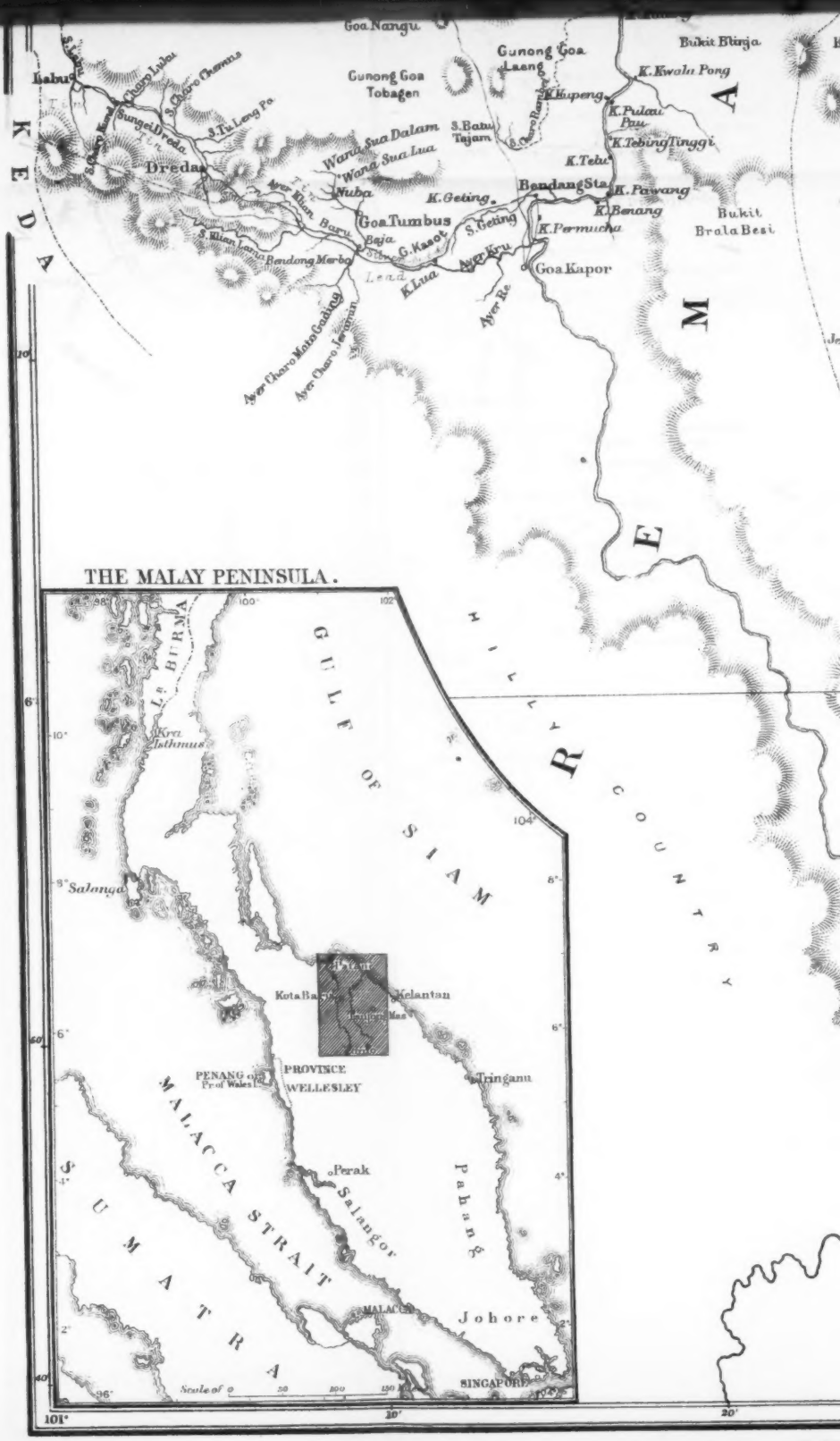
Reference.

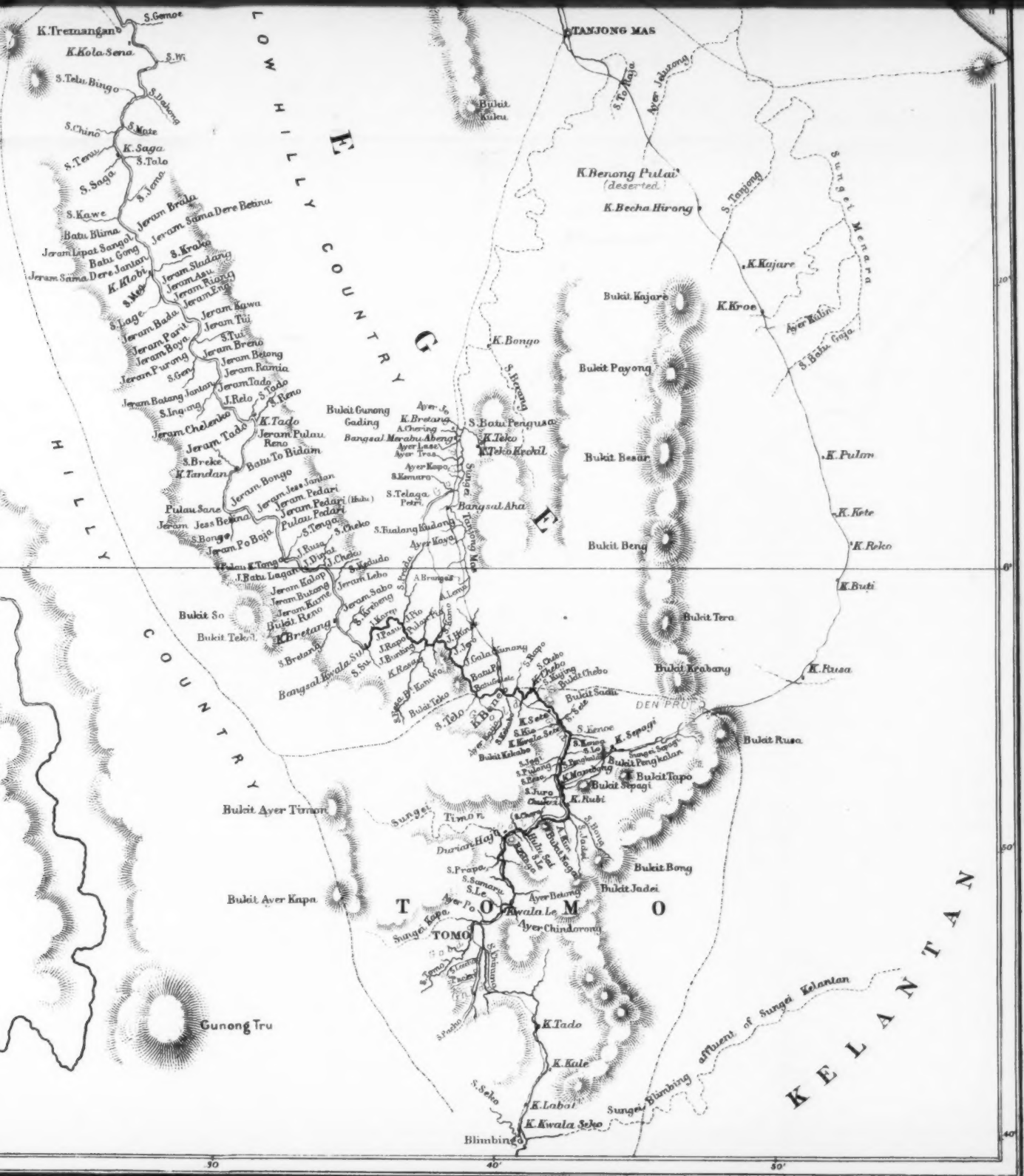
A., Ayer ..... Stream
B., Bukit ..... Hill
Gunong ..... Mountain
J., Jeram ..... Rapid
K., Kampong ..... Village
Kwala ..... River mouth
S., Sungei ..... River




K. Tenong
K. Tanjong
K. Benang
B. Bilu
K. Bleka
K. Pau
K. Benang Patai
K. Benang Raya
K. Machang Kope
KOTA BARU
K. Patai
K. Purong
K. Lanjut
K. Chetong
JALOR
K. Kampinang
K. Rope
Bukit Kamptnang
K. Chiga Uti
Bukit Rubeng
Bukit Drape
K. Sied
Bukit Sied
K. Kluang
Goa Nangu
Bukit Blinja
Gunong Goa Laeng
Gunong Goa Tobagen
K. Kwala Pong
K. Kupeng
K. Pulau Pau
K. Tebing Tinggi
K. Tebu
Bendang Sta
K. Pawang
K. Benang
Bukit Brala Besi
K. Permucha
K. Geting
Goa Tumbus
Baja
G. Kasot
Ayer Kru
Goa Kapor
K. Lua
Ayer Re
Bendang Merbo
Ayer Charo Mata Gading
Ayer Charo, Jerangan
Labu
Dredas
Wang Sua Dalam
Wang Sua Lua
Nuba
Ayer Kluan Baru
S. Batu Tajam
KEDA
PAHANG
THE MALAY PENINSULA.
GULF OF SIAM
MALACCA
Kra Isthmus
Salanga
Kelantan
Tringanu
PENANG or Prov. Wellesley
PROVINCE WELLESLEY
Perak
HILLY COUNTRY

K. Kalabo
S. Landas
S. Ate
K. Bhuker Pallas
K. Ate
K. Telo Gedingo
K. Laher
K. Bala
K. Tebong Runto
K. Sumpit
K. Jeriam
Pengkalan Jeriam
S. Batu Bisi
K. La. Kaja
K. Jeriam
K. Reso
S. Liang
Dakun's road from Kota Baru to Tanjong Mas
K. Tremangan
S. Genoe
K. Kola Sena
S. Telu Bingo
S. Chino
S. Mate
S. Teru
K. Saga
S. Tato
S. Saga
S. Jeno
S. Kawe
Batu Rima
Jeram Lipat Sangal
Batu Gong
Jeram Sama Dere Jantan
K. Mobi
S. Mobi
Jeram Brala
Jeram Sama Dere Betina
S. Kraka
Jeram Sladang
Jeram Asu
Jeram Rieng
Jeram Ena
S. Lage
Jeram Bada
Jeram Pari
Jeram Baya
Jeram Purang
Jeram Kawa
Jeram Tui
S. Tui
Jeram Breno
Jeram Betong
Jeram Ramia
S. Gen
Jeram Batang Jantan
Jeram Tado
S. Tado
S. Ingang
J. Relo
K. Reno
Jeram Chelenko
K. Tado
Jeram Tado
Jeram Pulau Reno
S. Breke
Batu To Bidam
K. Tandan
Jeram Bongo
Jeram Jess Jantan
Jeram Pedari
Pulau Sare
Jeram Jess Betina
Jeram Pedari (Hulu)
Pulau Pedari
S. Tengo
S. Cheko
S. Bongo
Jeram Po Baje
J. Rusa
J. Dinka
J. Cheko
Pulau K. Tengo
J. Batu Lagan
S. Keludo
Jeram Kolop
Jeram Lobo
Jeram Butang
Jeram Sabo
Jeram Kante
S. Krabang
Bukit Reno
Bukit So
Bukit Teko
K. Bretang
S. Bretang
Bangsal Kwala Sub
S. Gelli
K. Jeringo
K. B.te Palo
Bukit Tanjong
S. Djendra
Sungei Tanjong Mas
TANJONG MAS
S. To Kaja
Ayer Jabutong
Bukit Kuku
K. Benong Pulai
(deserted)
K. Becha Hirong
S. Tanjong
Sungei Menara
K. Kajare
Bukit Kajare
K. Kroe
Ayer Kabu
S. Batu Gaja
K. Bongo
S. Barang
Bukit Payong
Bukit Besar
K. Pulau
K. Kete
Bukit Beng
K. Reko
K. Buti
Bukit Tero
Bukit Krabang
K. Rusa
Bukit Rusa
Bukit Tapo
Bukit Sepagi
K. Rubi
Bukit Bong
Bukit Jadei
Bukit Ayer Timon
Bukit Ayer Kapa
Sungei Timon
Durian Haji
S. Prapa
S. Samara
Ayer Belang
Kwala Le
Ayer Chindorong
TOMO
Ayer Po
Sungei Kapo
Bukit Gunong Gading
Bangsal Marabu Abang
K. Bretang
A. Chering
Ayer Lasa
Ayer Tras
K. Teko
K. Teko Kechil
S. Batu Pengusa
S. Kemaro
Ayer Kapo
S. Telaga Petri
Bangsal Aha
S. Tualang Kudong
Ayer Kaya
Ayer Jo
A. Bramei
A. Lemp
Bukit Chebo
Bukit Sadli
Bukit Kekabo
Bukit Peng kalan
S. Juro
Bukit Sad
S. Prapa
S. Samara
S. Le
Ayer Belang
Kwala Le
Ayer Chindorong
HILLY COUNTRY
LOW HILLY COUNTRY
DEN PRO
TAN
20'
10'
0'
50'


KEDAH
Goa Nangu
Gunong Goa Laeng
Bukit Birja
K. Kwala Pong
Gunong Goa Tobagen
K. Lapeng
K. Pulau Pau
K. Tebing Tinggi
S. Batu Tajam
K. Tebu
Bandang Sta
K. Pawang
K. Benang
Bukit Brala Besi
Dredas
Wana Sua Dalam
Wana Sua Lua
Nuba
K. Geting
Goa Tumbus
Baja
S. Geting
K. Permucha
G. Kasot
Goa Kapor
K. Lua
Ayer Kru
Ayer Re
Bendong Merbo
Ayer Charo Matagading
Ayer Charo Jeraman
THE MALAY PENINSULA.
Le BIRMA
Kra Isthmus
GULF OF SIAM
HILLY COUNTRY
Salanga
Kota Bahru
Kelantan
PENANG or Prof Wales
PROVINCE WELLESLEY
Tringanu
Perak
Salangor
Pahang
MALACCA STRAIT
SUMATRA
MALACCA
Johore
SINGAPORE
Scale of
Publ



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